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AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS, AND BLACKSMITHS.

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Sketch of the Life of William Woodcock.

The decease of William Woodcock at his residence in Elizabethport, N. J., Nov. 27th, has already been referred to in the AMERICAN MACHINIST. We present this week a portrait engraved from a recent photograph.

Mr. Woodcock was a native of England, and came to this country in his boyhood. His youth and the greater part of his life was spent in Pennsylvania. He entered the railroad shop at Parksburg, Chester County, Pa., and there learned the trade of a machinist. Through constant study, perseverance and hard work he soon established for himself an excellent reputation as a remarkable, skillful and practical mechanic in everything connected with locomotive construction. His ability and integrity were recognized by the officers of the works; and when these shops were removed to Harrisburgh Mr. Woodcock became the foreman. Afterwards he was appointed foreman of the locomotive repair shops at Scranton, Pa. This position he resigned to accept the superintendency of the machine shops at Ninth and Greene streets, Philadelphia.

In 1870 Mr. Woodcock accepted the position of master mechanic of the railroad works situated at Elizabethport, and belonging to the Central Railroad of New Jersey. In that capacity he had charge of all the shops of the Philadelphia and Reading Railroad on the Central Long Branch and New Jersey Southern branches. This position he held until the time of his death.

Here he proved himself to be a thorough practical locomotive and car builder. Through his kind and courteous conduct he made many warm and lasting friends; and through his just and fair dealings with all his workmen gained their highest esteem. This was sincerely shown in a meeting of the workmen held in the round house, the day before his funeral. At this meeting it was decided that all should attend the funeral in a body. Resolutions were adopted showing their high esteem and respect of the friend whom they had known so long. A representative of the AMERICAN MACHINIST who was present at this meeting heard it said by the workmen that language, however strong in praising the life and conduct of their leader, could not reach beyond the truth.

The resolutions adopted were as follows:

Whereas, The employes at these shops have heard with profound regret and sorrow the announcement of the death of Master Mechanic William Woodcock, which occurred on the morning of the 27th day of November, 1886; and

Whereas, It is fit and proper that the employes should give expression of their high appreciation of his character, and unite with sympathizing friends in deploring the demise of one of our fellow citizens,

Resolved, That in the death of William Woodcock we have lost a valuable citizen and cherished friend, and we sincerely mourn his loss; and,

Resolved, That the employes of the Elizabethport shops attend the funeral in a body; and

Resolved, That the heartfelt condolence of the employes is hereby tendered to the relatives of deceased, and that we bow with them in submission to the will of Him who doeth all things well.

Resolved, That a copy of the foregoing resolutions be transmitted to the relatives of deceased and published in the daily papers.

Mr. Woodcock was also a prominent member of the American Railway Master Mechanics' Association, and at its last session was elected president of that body. He was a recognized authority on all matters appertaining to locomotive, car building, and general railroad construction, and was also an able writer on those subjects.

Mr. Woodcock was only 51 years of age at the time of his death. He was a man of quiet and unassuming manners, but was very active and full of energy. Not only did he attend faithfully to his duties and responsibilities placed upon him by the railroad company, but he was also greatly interested in the welfare of the city in which he lived. He was a member of the Board of Directors of the Elizabeth General Hospital and Dispensary, and a trustee of the Evergreen Cemetery. At the time of his death, he was, and had been for several years, a member of the Board of Health, in which his mechanical skill was of great practical use in matters of this department. He was once a candidate for member of the Board of Education, and was elected in a ward in which the opposition party element was very great. Mr. Woodcock served well his constituency, and brought an experience in educational and mechanical affairs into the management of the schools that will be of permanent benefit.

He was a man of great benevolence, doing much for charity that escaped publicity, but was frequently heard of through his beneficiaries.

He was connected with several benevolent institutions, and was an active church worker. In none of his public relations will his loss be more severely felt than in the church in which he was one of the elders.

He was a member of the Knights Templar Commandery in Lancaster, Pa.

Mr. Woodcock leaves no immediate family. His wife died a few years ago. A sister and brother survive him.

WILLIAM WOODCOCK.

Western Railway Club, of Chicago.

At the Dec. 15th meeting of this club, one of the questions discussed was "What is the best form of packing for piston heads and for stuffing boxes?" Mr. Johnson (C. B. & Q. R. R.) opened the discussion as follows:

I am not prepared, Mr. President, on the subject, as I have been very busy, and I would not like to take up the subject of cylinder packing, but as to stuffing-box packing I will say a few words. We are using metallic packing exclusively. It has been in use on the C., B. & Q. Road since the fall of 1881. We find that piston-rods average a mileage of 50,000 miles without turning. We then turn off an average of $\frac{3}{64}$ of an inch. We reduce our piston rods from 3" to 2½" or ½" before throwing out, this giving us a wear of 1,600,000 miles on piston-rods per engine. Putting the average mileage of all engines at 50,000 miles per year, this would make the life of piston, so far as packing is concerned, 32 years, or more than the average life of an engine. As a matter of fact, in the past five years that this packing has been used by the C., B. & Q., in no single instance has there been a piston-rod removed on account of wear. There is no case where an engine has been laid in to turn either the piston rod, or valve stem, on account of leaking. The wear of the valve stem is greater than the piston-rod, and not as true, the valve stem wearing more on the top and bottom, leaving the stem somewhat oblong. We find the average mileage of valve stems to be about 25,000 miles without turning, when they require from $\frac{3}{64}$ to $\frac{1}{32}$ of an inch to true up. Of the engines equipped with this packing in 1882 there has yet been no case of a valve stem being removed. This packing costs, complete, ready to put on an engine, for piston and valve stems, $23.05. The cost of maintaining this packing is extremely light. Three passenger engines, making 250 miles daily, with our heaviest through trains, being handled by separate crews—there being six crews to run the three engines—each following the other around, have, from May 1st, to December 1st, 1886, only used 36 cents worth of material each. This represents the six lbs. metallic packing rings. Freight engines require a set of packing rings on an average of once in three months. Switch engines an average of once each month. I find that the records of the amount of hemp used have been destroyed. Piston and valve stem wear, however, with hemp, was very remarkable. The average life of a steel piston-rod with hemp was four years. The average of a valve stem with hemp did not exceed two years At one shop where there were 110 engines, it took one lathe constantly turning valve stems, and two lathes on piston and piston-rod work. At the present time in the same shop with 120 engines, one lathe does all the piston and piston-rod work, and a considerable portion of the valve stem work. This includes all new work and repairs.

A Member—What is the name of that packing that you use?

Mr. Johnson—It is the Jerome packing, somewhat modified. We have made some slight improvements—or what we consider improvements—on the original design given us, but it is practically the Jerome packing. Those engines that I spoke of, make about 7,000 miles a month. They are operated by new crews; there is no regular engineer on them. Our practice is to have one man in the shop do all the lathe work, and the work in the round-house of replacing the packing rings is all done by one man.

Secretary Sinclair—Mr. President, I have had some experience with that packing Mr. Johnson has been speaking of, and I found it very efficient and very economical. I had charge of two engines that had it, which were working continually on switch work

day and night, and engines that were doing the same kind of service, but were using hemp packing generally needed to be packed twice or three times a week, the best they could do with them, while that metallic packing lasted the two engines a whole year with very little change, only a few additional rings being put in. I do not believe the expense for each of the engines exceeded a dollar during the whole year; and, in addition to the smaller expense for packing, we found it a very great convenience in preventing delay from putting the hemp packing in. When an engine is running in a yard where they are very much pressed for work, and doing work with double crews, it is often of great importance to have no delay in putting in packing, and where you are using hemp packing it often happens that it blows out just at a most inconvenient time, and if you cannot put a new lot in you must lose a good deal of steam before it is possible to repack the engine. In running engines myself I have had experience with most kinds of packing that have been used. I have used flax and hemp and other kinds of piston packing, and I think that hemp is the most expensive packing that was ever put into an engine for any purpose. Some of the metallic packing does not suit well because it is not mechanically a good arrangement. Unless a packing is made so that there will be some means of compensating for the rise and fall of the piston rod it is not going to wear well, especially a metallic packing. A fibrous packing, like hemp, may have enough elasticity to it to fill up an opening when a hole is made by the rise and fall of the cross-head, but metallic packing has not that, and unless there are means taken to let the ring rise and fall with the piston, the rod squeezes a hole in the top or bottom of the ring, makes it elliptical, and the steam blows out there. That has been the cause of difficulty with so many kinds of metallic packing, that they did not make provision for that rise and fall. It would be all right so long as the guides were perfectly fitted to the cross head, or the cross-head to the guides, but as soon as there was some lost motion so that the cross-head would jerk at the ends of the stroke the action would destroy the packing so that it would leak badly, and in that way it would never be kept tight; and whenever we screw up on it and try to prevent the leaks it squeezes the sides of the piston rod. Metallic packing of a bad form is much harder on the rod than fibrous packing is, but metallic packing, if well made, is certainly the most economical that can be used. That is my experience.

Mr. Johnson—Last spring I fitted up a set of Corliss double engines with metallic packing, and there has not been a penny's worth of labor put on to that packing up to this day, and piston rods are as true as can possibly be under the circumstances. Of course they are not absolutely true, but there is not a particle of blow there, and they are as nice as they can be. The remarks that Mr. Sinclair has just made are very correct so far as that wear is concerned. If there is not that allowance made for that motion metallic packing is not at all economical, but with that allowance this packing, as constructed by ourselves, gives no trouble whatever, and I do not see how any railroad company can afford to run any other kind but metallic packing.

Mr. Casanave—I know of some metallic packing that has cost nearly 19 cents per thousand miles to keep in repair, and we have had experience with some that has proved equally as expensive as hemp. I rather think that the parties who handled it did not understand how to take care of it.

Mr. Smart—Was the packing that you refer to automatic in its adjustment to the wearing of the rod?

Mr. Casanave—Yes, sir, it was.

Mr. Smart (Michigan Central Railroad)—We are using hemp on nearly all of our engines. We have eight that have metallic packing, but I have not used it long enough to determine the cost of maintenance nor the actual wear, but we have one passenger engine in service that has run 41,000 miles during about seven months, and it has shown hardly any wear on the rods. Taking the caliper of rods up and down you can hardly feel the difference, it is just barely perceptible. On the under part of the rod it is perhaps worn in the neighborhood of a hundredth part of an inch. We have six Mogul engines fitted up with the same kind of packing, and it seems to be doing very well, but they have not been in the service long enough to determine it; the wear is hardly perceptible. We have not had to replace any of the rings except in two cases, and that was due to the fact that something was put in wrong end to and didn't adjust itself, and for that reason we were obliged to replace the ring. I think that metallic packing is the only thing we can afford to use. I do not think we can afford to use hemp packing, as I think it is much more expensive. I think the packing ought to be automatic in its action, and the metallic rings as well, otherwise if it is put in the hands of an engineer who can control the packing he is liable to screw it up a little too tight, and the result is that your packing is gone in about a half a minute.

Secretary Sinclair—There is just one point I would like to make on that metallic packing matter. I have been watching it somewhat. It seems so curious that a packing will do well on one road and not on another, and I made some inquiries about it a short time ago on a road where it hadn't done well, and I found that they put the packing on just as the engines happened to come in, without truing up the piston rods or valve stems, and they had no success with it at all. Now, I think that you cannot apply that packing successfully without having the rods perfectly true, and if they are true in the first instance they are liable to continue true, but if you apply the packing when they are worn in the middle it is impossible to get it to keep tight, and the packing will be destroyed in screwing it up and trying to make it tight when it is really not the blame of the packing but of the rods not being trued.

Mr. Rhodes (C. B. & Q.)—From the statement made by Mr. Johnson the members might think that the packing he refers to has always done well. Such is not the case. There was considerable trouble with it on our road, and when I first went there several of our master mechanics urged me to abandon it on switch engines.

Mr. Johnson—It is very true that no railroad company can jump into the use of this metallic packing. There must be a great deal of painstaking work; it must be carried along patiently and cautiously. I well remember the trouble and annoyance that we had on the C., B. & Q., referred to by Mr. Rhodes, but it is now a complete success.

Mr. Reynolds—(Chicago, St. Louis and Pittsburgh). We are using metallic packing. We have one engine, that I remember now in particular, that made about 60,000 miles with no expense whatever. We are using it on all of our engines. The packing costs about $45, but its manufacture costs only about $13. It is only a question of patent.

BEANE'S RATCHET PIPE STOCK.

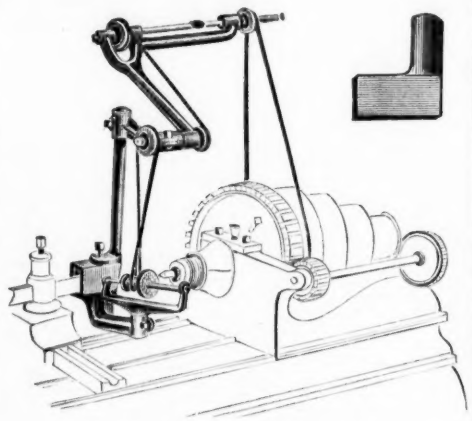
Mr. Johnson—As to the lubrication, after considerable experiment we finally settled upon an automatic feeding cup, to attach to the top of the glands—identically the same cup we use on the guide-rod, only a little smaller.

Mr. Rhodes—Up in Iowa the engines are kept lubricated with swabs. It may be that the master mechanics on those divisions could not show the results Mr. Johnson has, but they did good results by keeping these swabs well lubricated.

Secretary Sinclair—My experience is that a swab is a better thing to lubricate a piston with than a gland. I have always found if you used a hollow gland it would choke up with sedimant in the bottom and would very often fail to feed at a most important time, and the swab is always wet if you give it a little oil now and then.

Mr. Johnson—I do not agree with that at all. This cup that I speak of is a perfect working cup. With a swab cinders and dust work in, and you are cutting your piston-rod.

Secretary Sinclair—With a cup when a drop of oil goes down about half of it goes to the ground, while what you put on to the swab remains there, is always wet, and is giving and taking. If you use a cup you had better use a swab too, because that holds the oil from running off.



UNIVERSAL CENTER GRINDER.

Mr. Johnson—You want to get the right kind of cup that will regulate a very fine supply of oil.

Universal Center Grinder.

The center grinder shown herewith is applicable to any turning lathe, and can be used for grinding a variety of small hardened work, as well as centers.

The grinder can be quickly attached, being held in place on the blank end of any tool that fits the tool post. But one length of belt is required for different lathes, as the swinging arm can be moved to suit variations. The belting being from the lathe cone, makes it possible to run the work with the lathe in back gear, at the same time keeping up the speed of the emery wheel. The universal head that carries the wheel can be set at any desired angle, or reversed, if necessary to accommodate odd-shaped work. A button on the wheel drum provides for moving the wheel backward and forward over the work.

The attachment shown in the small engraving is for use on hand lathes having no carriage.

The manufacturers are the E. E. Josef Manufacturing Company, Buffalo, N. Y.

Beane's Ratchet Pipe Stock.

This stock is shown with one of the handles removed. In this shape it can be used for threading pipes in the corner of a building, or in other close places where but a small part of one revolution can be continuously made, the operation being the same as that of a ratchet drill. Moving the pawl reverses the motion for running off.

With both handles in place the ratchet can be used if desired, or by turning a set screw it can be used as an ordinary stock.

The ratchet is so boxed in as to prevent dirt or chips getting to it.

The manufacturer is B. C. Beane, Newark, N. J.

Owing to the crowded state of our columns this week, we are obliged to omit part of the proceedings of the Western Railway Club; also a number of letters from machinery establishments, noting the condition of business and prospects for the year 1887. Both will appear in our next issue.

Practical Drawing.

BY J. G. A. MEYER.

TWELFTH PAPER.

124. To the drawing board fasten another sheet of drawing paper, and divide it into the same number spaces as was done on the first sheet; mark the spaces in their upper left-hand corners, Probs. 13 and 14, etc.

The student will find by experience that the edges of the sheet will soil very quickly and that when finally the sheet is to be cleaned it will be very difficult and annoying to clean its edges. We therefore recommend the selection of a sheet whose size is $20'' \times 25''$ instead of $19'' \times 24''$. On this sheet draw two sets of border lines, as shown in Fig. 96.

The first set of border lines should be drawn one-half of an inch from each edge of the sheet, and the second set of border lines should be drawn $1\frac{1}{2}$ inch from the same edges, leaving a space of one inch between the two sets of border lines, as indicated by figures in Fig. 96. When all the problems on this sheet have been drawn and inked, the sheet must be cleaned throughout and as near to its edges as possible; then cut off along the outer border lines, leaving a clean finished sheet $19'' \times 24''$, which will be the same size as that of the first sheet. Often draftsmen use the space between the edges of the sheet and the first set of border lines for trial lines and gauging their pens to the proper breadth of lines. This is well enough for experienced draftsmen to do, but we cannot advise the inexperienced student to do likewise, as he will soon have the edges of the sheet so black, which will have a discouraging instead of an encouraging effect. Always use a separate piece of drawing paper (article 123) on which trial lines can be made and the pen gauged to the proper breadth of line.

Problem 12.

125. TO FIND THE CENTER OF A GIVEN CIRCLE.

Let $A\ B\ D$, Fig. 97, be a given circle; it is required to find the center of the same.

Fig. 97. Take any three points as A B and D in the circumference, these points need not be equal distances apart. Join the points A and B by a straight line or chord; also join B and D by a chord. From the point A as a center and with a radius greater than half the distance from the point A to B describe an arc i; from the point B as a center, and with the same radius, describe an arc j, intersecting the former arc in the points e and f; through the points e and f draw a straight line. From the point B as a center and with a radius greater than half the distance $B\ D$ describe an arc l, and from the point D as a center, and with the same radius describe an arc k intersecting the arc l in the points g and h; through the points g and h draw a straight line, cutting the line previously drawn through the points e and f, in the point C; this point C will be the center of the given circle. The line $e\ f$ will bisect the chord $A\ B$, and the line $g\ h$ will bisect the chord $B\ D$, and the manner adopted for bisecting these lines is the same as that explained in problem 4. It must also be remembered that bisecting the chord $A\ B$ may be regarded as a distinct construction; and bisecting the chord $B\ D$ as another construction of the same kind; therefore the radii used for the arcs k and l need not be the same as the radii used for the arcs j and i; although for the sake of convenience draftsmen generally use the same radius for drawing all these four arcs. But it must be distinctly understood that, although it is correct to use a certain radius for drawing the arcs i and j and a different radius for drawing the arcs k and l, it would be totally incorrect to use one radius for drawing the arc i, and a different radius for the arc j; and it would be equally incorrect to use a certain radius for drawing the arc k, and a different radius for the arc l. The radii used for drawing the arcs j and i must be alike; and the radii used for the arcs k and l must also be alike; although the radii of the former two arcs can be greater or less than the radii of the latter two arcs.

In geometry it is proved that a line drawn through the center of a circle and perpendicu-

lar to a chord will bisect the chord, and therefore, conversely, if a line is drawn perpendicular to a chord through its middle point, this perpendicular line will pass through the center of the circle. Consequently if we draw perpendiculars through the centers of two chords, these perpendiculars must intersect each other in the center of the circle.

Again it must readily be seen, that the same construction as illustrated in Fig. 97 will enable us to draw a circumference through any three given points not contained in one straight line.

Directions.—In the space marked Problem 13 draw any circle, and assume that its center is to be found; then find the center in a manner as explained in this article.

Draftsman's Method.—The draftsman has no special method for finding the center of a circle, and for this purpose must adopt the geometrical method just explained.

126. The center square illustrated in Fig. 98, which the machinist uses for finding the center of a circular hole is constructed on the principles set forth in the foregoing article. It will be noticed that the edge *a b* of the blade is set square with the edge *c d* of the head, and also that the edge *a b* passes through the center of *c d*, so that when the head of the center square is placed against the inner surface of the hole, the edge *c d* represents a

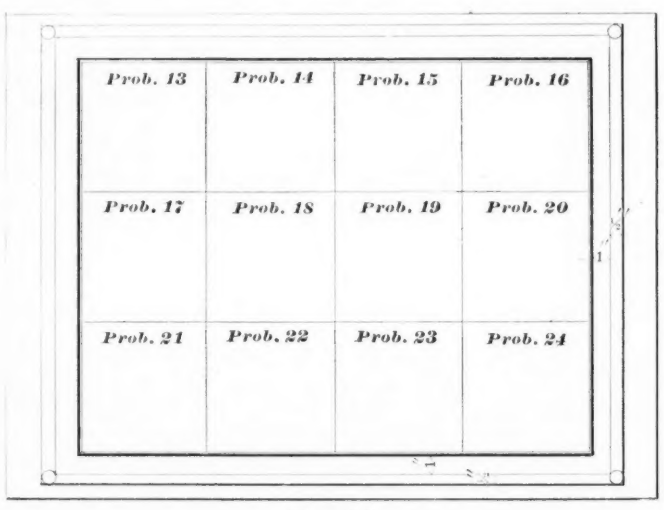


Fig. 96

chord, and *a b* a perpendicular passing through the center of the chord. Now, placing the square in position 1, and drawing a line along the edge *a b* on a piece of wood previously forced in the hole, and then placing the same square in any other position as 2, and again drawing a line along the edge *a b*, the point of intersection of these two lines on the wood will be the center required.

Problem 13.

127. TO DIVIDE A GIVEN STRAIGHT LINE INTO ANY NUMBER OF EQUAL PARTS.

Fig. 99. Let *A F* be the given straight line; it is required to divide this line into five equal parts.

From one extremity as *A* of the given line draw a straight line *A M* of any convenient length, it may be longer or shorter than the given line *A B*. The line *A M* may also incline more or less towards the line *A F*; or in other words the angle formed by the lines *A M* and *A F* may be of any magnitude. But, practically, for obtaining accurate results, and for the sake of convenience it is always best to draw the line *A M* in such a position in which it will form with the line *A F*, an angle less than a right angle; an angle of about 30 degrees will give good results.

On the line *A M* lay off any convenient length, as *A H*, and from the point *H* lay off on the line *A M* four equal parts, *H I*, *I J*, *J K* and *K L*, each equal to *A H*. Join the points *L* and *F* by a straight line, *L F*. Through the points *H*, *I*, *J* and *K* draw straight lines parallel to the line *L F*; these lines will intersect the line *A F* in the points *B*, *C*, *D* and *E*, and divide the given line *A F* into five equal parts.

It will be noticed that the lines *A F*, *A L* and *F L* (Fig. 99) form a triangle. Now, in geometry it is proved that if in a triangle as *A L F*, lines *K E*, *J D*, etc., are drawn parallel to one of its sides, *F L*, so as to divide one of the other two sides, *A L*, into equal parts, *A H*, *H I*, etc., the third side, *A F*, is also divided into equal parts. Consequently we conclude that since the parts *A H*, *H I*, etc., on the line *A M* are all equal by construction, lines drawn through the points of division *H*, *I*, etc., parallel to *F L*, must also divide the line *A F* into equal parts.

Dividing a straight line in this manner, slight inaccuracies will occur in drawing the lines through the points *H*, *I*, *J*, etc. Therefore, after a construction of this kind has been completed, it is always best to test the divisions on the line *A F* with the aid of the plain dividers, and make such corrections as will be found necessary, although, when care is exercised in making these constructions, few, if any, corrections will be necessary.

Directions.—In the lower part of the space marked Prob. 14, draw any straight line; assume this line to be the given straight line. Divide this line into any number of equal parts (say, seven, eight or nine) in a manner as explained in this article.

Draftsman's Method.—Some draftsmen will adopt this geometrical method for dividing a straight line into equal parts; others again, will use the plain dividers, and by trial accomplish similar results.

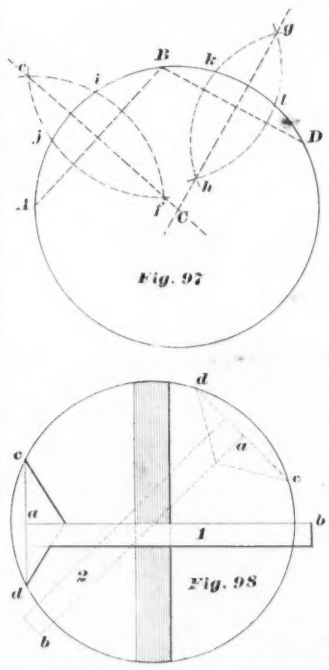


Fig. 97

Fig. 98

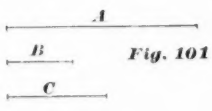


Fig. 101

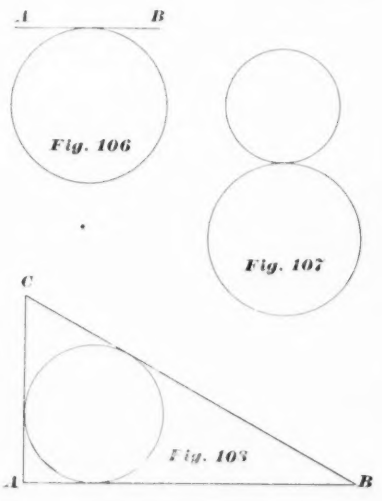


Fig. 106

Fig. 107

Fig. 102

Problem 14.

128. TO DIVIDE A GIVEN LINE INTO PARTS WHICH SHALL BE PROPORTIONAL TO ANY GIVEN LINES.

Let *D E* in Fig. 100 be the given line, it is required to divide the line *D E* into parts which shall be proportional to the lines *A*, *B* and *C* shown in Fig. 101.

From the extremity *D* of the given line *D E*, (Fig. 100), draw a straight line *D F*, whose length is greater than the sum of the three lines *A*, *B* and *C*. The angle formed by the lines *D F* and *D E* may be of any magnitude; but in order to obtain conveniently accurate results, draw the line *D F* in a position in which it will form, with the line *D E* an angle less than a right angle. From the point *D* on the line *D F*, lay off a distance *D G* equal to the length of the line *A*; from the point *G* lay off on the same line a distance *G H* equal to the length of the line *B*; and again on the same line lay off from the point *H* a distance *H I* equal to the length of the line *C*. Join the points *E* and *I* by a straight line. Through the point *H* draw a straight line *H L* parallel to *E I*; through the *G* draw *G K* also parallel to *E I*; then will the parts *D K*, *K L*, and *L E* of the line *D E* be proportional to the lines *A*, *B* and *C*; that is if the length of the line *B* is equal to one-quarter the length of the line *A*, then will *K L* also be equal to one quarter of *D K*; and if the line *C* is equal to one-half of the line *A*, then will *L E* also be equal to one-half of *D K*. If the given line *D E* is less than the sum of the three given lines *A*, *B* and *C*, then of course the parts *D K*, *K L* and *L E* will be proportionally shorter than the lines *A*, *B* and *C*; and if on the other hand the given line *D E* is greater than the sum of the lines *A*, *B* and *C*, then its parts will also be proportionally greater than the lines *A*, *B* and *C*.

In geometry it is proved that if a line, as *H L* (Fig. 100) is drawn through two sides of a triangle as *D I E*, parallel to the third side *I E*; it divides the two sides *D I* and *D E* proportionally.

Directions.—In the upper part of the space marked Problem 15, draw any three lines of unequal length similar to *A*, *B* and *C* shown in Fig. 101, and mark these lines in the same manner. In the lower part of the same space draw a line *D E* as shown in Fig. 100, the length of this line should be either greater or less than the sum of the three lines *A*, *B* and *C* previously drawn in this space. Then divide the line *D E* into parts which will be proportional to *A*, *B* and *C* as explained in this article.

Draftsman's Method.—For dividing a line proportionally to other given lines, draftsmen either adopt this geometrical method, or obtain the same result by calculation.

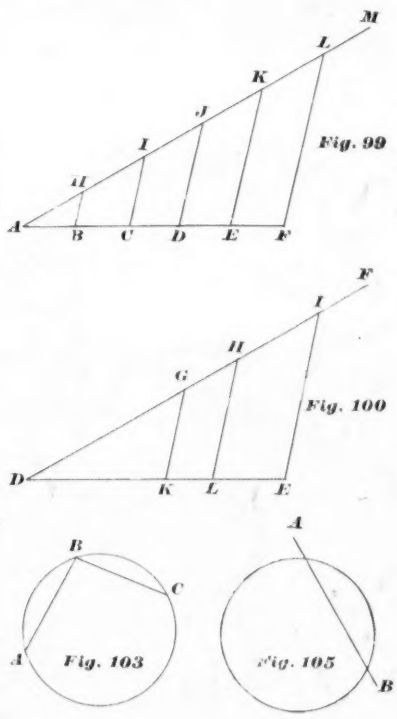


Fig. 99

Fig. 100

Fig. 103

Fig. 105

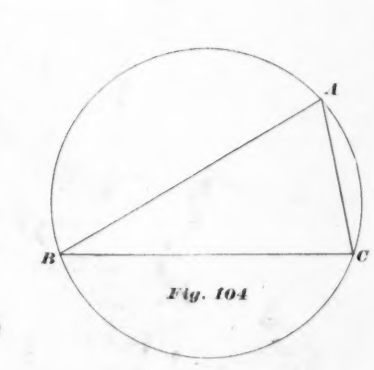


Fig. 104

Definitions.

It is now necessary to give the following definitions. The student should not pass over these hastily, but should commit them to memory.

129. In the definition given in article 28 we see that a plane figure is a plane bounded or terminated on all sides by lines. Now, if the boundary lines are straight, the space which they contain is called a rectilineal figure, or polygon, and the sum of the bounding lines is the perimeter of the polygon.

130. A polygon of three sides is called a triangle; a polygon of four sides is called a quadrilateral; that of five sides is called a pentagon; and that of six, a hexagon, etc.

131. An equilateral polygon is one whose sides are all equal in length. See Fig. 102.

132. An equiangular polygon is one whose angles at *A*, *B* and *C* formed by the sides are all equal. See Fig. 102.

133. A regular polygon is a polygon which is both equilateral and equiangular, as shown in Fig 102.

It is to the regular polygons to which we shall call particular attention.

134. A diagonal of a polygon is a straight line joining the vertices of two angles not adjacent.

135. A base of a polygon is any of its sides on which it is supposed to stand, for instance in Fig. 102, the side *F E* is considered to be the base.

136. An angle of a polygon is any one of the angles formed by the sides; thus, in Fig. 102, the angle *A B C* formed by the sides *A B* and *B C* is an angle of the polygon, so also the angles at *C*, *D*, etc., are angles of the polygon.

137. An inscribed angle is an angle whose vertex is in the circumference of a circle, and whose sides are chords. Thus the angle *A B C*, Fig. 103, is said to be inscribed, because its vertex is in the circumference and the sides *A B* and *B C* are chords.

138. An inscribed polygon is a polygon whose vertices are all in the circumference, and the sides are chords. Thus the triangle *A B C*, Fig. 104, is said to be inscribed, because the vertices of the angles at *A B* and *C* are in the circumference, and the sides *A B*, *A C* and *B C* are chords. In this case the circle is said to be circumscribed about the triangle or polygon.

138. A secant is a straight line as *A B*, in Fig. 105, which cuts the circumference of a circle in two points.

140. A tangent is a straight line as *A B*, Fig. 106, which touches the circumference in one point only. This point is called the point of tangency, or the point of contact.

140. Two circles are said to be tangent to each other when they touch each other in one point as shown in Fig. 107. This point is called the point of tangency or the point of contact.

142. A polygon is said to be circumscribed about a circle when all of its sides are tangent to the circumference. Thus in Fig. 108 the triangle *A B C* is said to be circumscribed about the circle, because each of its sides, *A B*, *B C* and *A C* touch the circle in one point.

143. A circle is said to be inscribed in a polygon when its circumference touches all the sides of the polygon as shown in Fig. 108

The latest rumor of the universal possibilities of the South are in the direction of the "Cranberry" mine in North Carolina. It is claimed that this mine is practically inexhaustible, and that the ore is exactly suited to the manufacture of Bessemer steel. Large coal fields are said to be near at hand. This makes a combination that beats a gold or silver mine by odds. We hope that half that is said of coal and iron in North Carolina and adjacent parts of Tennessee is true. The drawback to a complete belief is that this somewhat astonishing news comes out in connection with the building of a railroad.

Fastening Locomotive Boilers to Frames.

In locomotives of the ordinary American type and designed to burn bituminous coal, the fire-box is generally placed between the driving axles and the frames, and fastened to the latter by frame clamps or pads *A*, as shown in Fig. 1. These pads are made of plate iron from $\frac{5}{8}$ to $\frac{3}{4}$ of an inch in thickness. They are planed to fit around the three sides of each frame, then heated and fitted to the boiler. Liners are placed between the inner sides of the frames and the outer sides of the fire-box, after which the pads are bolted to the boiler. This manner of fastening the boiler to the frames will allow the fire-box to move lengthways along the frames when the boiler expands or contracts, and at the same time will not allow it to move side ways. This manner of fastening the fire-box to frame has always given good satisfaction and is the favorite among master mechanics.

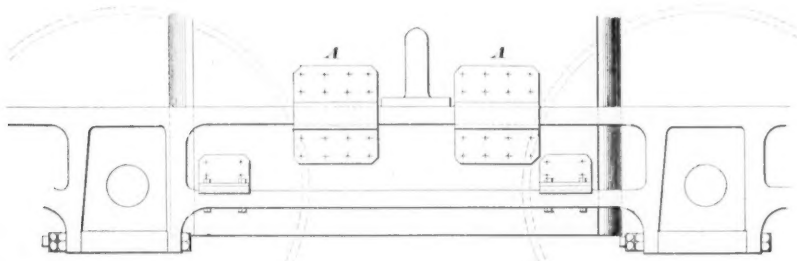


Fig. 1

For burning anthracite coal the grate area must necessarily be made greater than that required for burning bituminous coal; and since the frames will not admit a wider grate area, the fire-box is lengthened, as shown in Fig. 2, and supported by pads *B B B*, which are clamped to the frame.

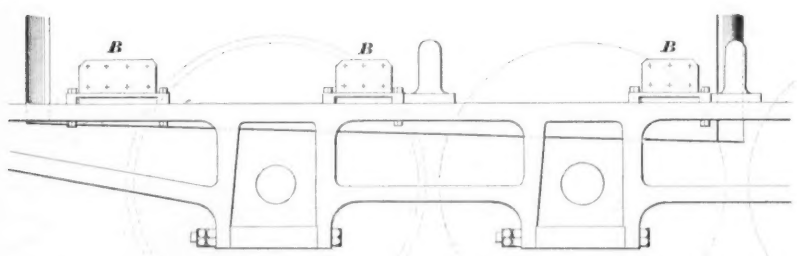


Fig. 2

Mr. John Headden, a practical, able and experienced locomotive builder and designer, who is at present the superintendent of the Roger Locomotive Works, has recognized for some time past the defects of the links employed for the purpose of holding the fire-box in position, as illustrated in Fig. 3, and has endeavored to devise a better, safer and more secure method of holding the rear end of boiler in position, and yet retain the wide fire-box.

The result of his study and labor is shown in Figs. 4 and 5. Fig. 4 represents a side view, and Fig. 5 a sectional end view of a locomotive having as wide a fire-box as can be placed between the driving wheels and securely fastened to the frames.

In this design, as will be seen by referring to Figs. 4 and 5, the fire-box is held in position by frame clamps, or pads, *D D*, constructed and fastened similar to those shown in Fig. 1. In order that the pads can be firmly secured to the back end of the boiler, the fire-box ring has lugs, *e*, forged on to it,

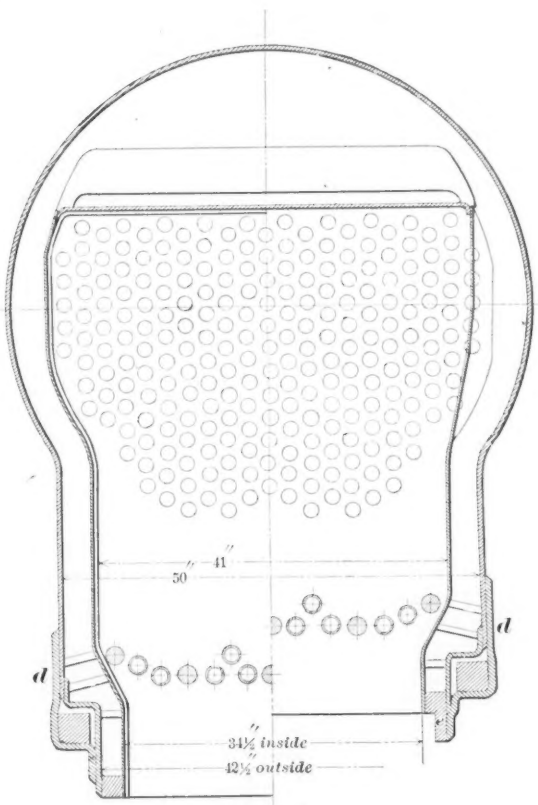


Fig. 5

to which the pads are bolted; at the front end of fire-box pads are fastened in the usual way. Cast-iron blocks are inserted between the bottom of fire-box and top frames, shaped and fastened in a manner which will allow the rear end of the boiler to slide lengthways, as it expands or contracts, but is prevented by the pads from moving out of line sideways, and thus greatly reducing the strains in the front end of each frame. We cannot conceive any reason why a boiler having a wide fire-box, and fastened in this manner, should not give entire satisfaction.

This design is not patented, and may be adopted by any one who may choose to do so. The Roger Locomotive Works are now building two locomotives, with boilers of this kind, and more are soon to follow.

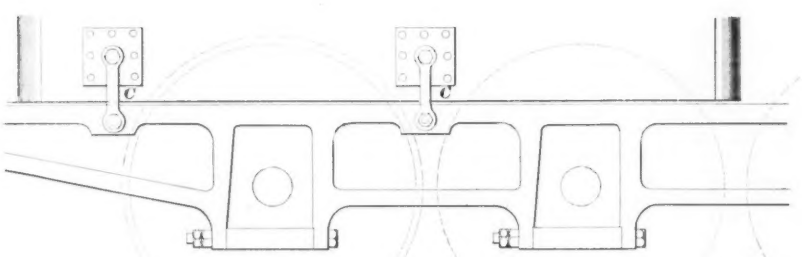


Fig. 3

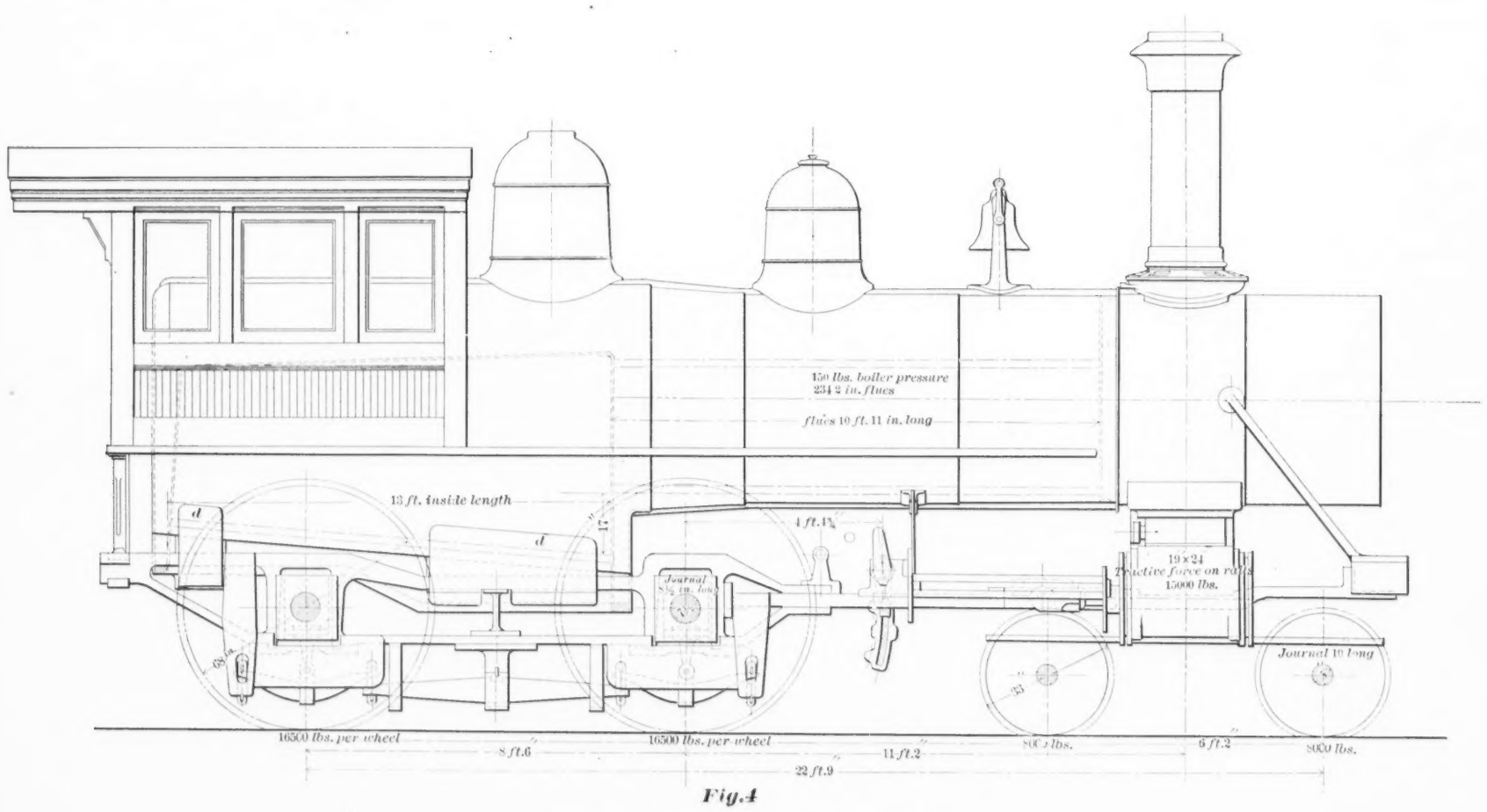


Fig. 4

FASTENING A LOCOMOTIVE BOILER TO ITS FRAME.

Moulding Pulleys.

BY ROBERT E. MASTERS.

Small jobbing shops or "country foundries" are generally not very well equipped with pulley patterns, and there is often a demand for a pulley to replace one that has a broken arm or a piece broken out of the rim. We illustrate the moulding of a pulley, using the old one for a pattern.

First plug the hole up in the hub with a piece of wood, then bore a hole in the center at each end for the core prints *A*, figs. 1 and 4. Cut a piece of board to fit close between the arms, and cast enough of these plates to fit all the spaces between the arms. A nut can be cast in the center of them for eye-bolts to be screwed into, as shown in plan fig. 2 and section *B B* fig. 3.

If it is a crown-face pulley, cast a ring to lift off the upper half of the outside; if moulded in a flask bed, place the pulley in the drag *C*, even with the joint of the arms, make the parting outside and put the ring on. Put in the lifting screws, and build the sand on the plate to the top of the rim *D D*. Rub the parting sand into this, draw out the lifting screws, and cover the holes.

Then fit the plates between the arms; the lifting screws in these plates are left in, and they must be long enough to extend above the cope *E* for a rod to go through the eyes so they can be secured on the cross bars af er the cope has been rammed up.

Fig. 1 is a section view of the mould through the arms of the pulley after the cope has been lifted off and the screws in the lifting ring returned to their places ready to lift it off. Fig. 3 is a section view of the cope between the arms of the pulley. By using the outside ring it gives a better chance to dress up the core in the cope than if the outside of the pulley was lifted by using a lot of gaggers or by driving nails in the side of the flask, and if the ring is made to fit right, it gives a cleaner "lift" than can be got by using a three-part flask to check off that portion of the pulley. After the pulley has been drawn and the ring set on again, the moulder can get at the joint to dress it up.

Fig. 4 is the same pulley, moulded in the floor, showing the parting *F F* for the sand on the lifting plate the reverse to what it is in fig. 1. If the pulley has a straight face, there is no use for a lifting ring, the pulley being bedded in the whole depth of the face. By leaving off that portion of the drawing below the dotted lines *G G*, we have a section view of the cope of a straight face pulley, whether moulded in a flask or in the floor.

Pulleys have been made on this plan for parties who are in a great hurry without casting lifting plates, the lifters, Fig. 2, being all made of wood and secured by long screws with either hooks or eyes on the end of them the same as at *H H*. By careful ramming all the work that was done in the machine shop was boring out and filing or grinding the face a little before it was put into service.

The plates, Fig. 2, show another plan for making a double arm pulley with pattern for one set of arms. Bed in the lower hub and first set of arms where they are required. Have the center hub straight and long enough to reach the second set of arms. Put in the single lifting plates, and instead of having an eye on the upper end of the lifting screws have a thread on both ends. Ram up to where the second set of arms ought to be, then put on the top lifting plate. This plate must have holes in it to let the rods of the lower plates come through. Screw nuts on the upper end of these rods down firm to the top lifting plate; draw out the band pattern, then lift out the core, take out the arms and lower hub, set the core back on again, return the band pattern deep enough so there will be no danger of ramming in below it, take the nuts off the rods and lift out the upper plate. Bed in the upper set of arms, make the parting, put the top lifting plate in again and finish the same as a single arm pulley. This plan saves breaking up the lower plate to get it out from between the two set of arms, and may save breaking the pulley in getting the plate out.

I want to take advantage of the opportunity here offered to call attention to a mistake that is ofttimes made by old moulders, but more especially by apprentices, in making partings, as at *D* and *F*. When parting sand is used, the moulding sand is riddled right into the mould and as it falls from the sieve it rolls down the incline, and takes the parting sand with it. The result is a "stick," or a ragged, broken joint. The better plan is to sieve the sand on the floor, and build up the joint from the bottom, the same as when the parting is made with paper.

Again, there is very little danger of a "crush" in partings like *D D*, or where the cope closes down on projections or overhanging sand, if the flask is clamped together before the cope is rammed up, about as it will be clamped when ready for the iron; and in moulds that are turned over don't leave a lot of loose sand between the board and the drag, but see the bottom board is down firmly to its place.

Fig. 2

Our contributor John J. Bingley, formerly a railroad master mechanic, has been appointed master mechanic of the Eames Vacuum Brake Company, Watertown, N. Y.

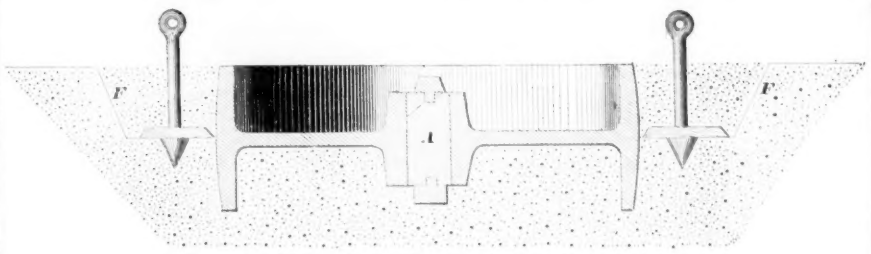


FIG. 4

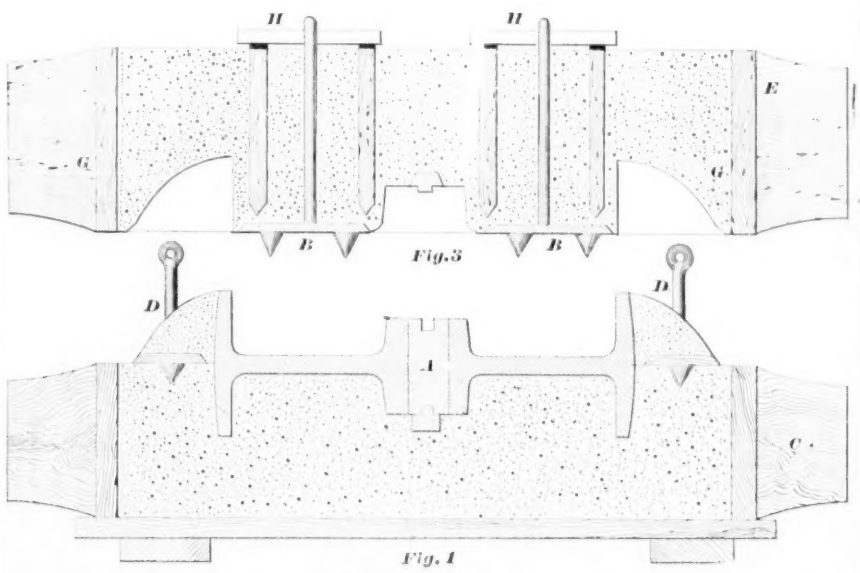


Fig. 3

Fig. 1

MOULDING PULLEYS.

Steel Making with Gas Fuel in Brooklyn.

The attention of the public has frequently been called, during the last few months, to the use of natural gas as a fuel in some of the Western cities. In Pittsburgh it has been quite generally adopted in the generation of heat for manufacturing purposes. When the gas flows naturally from wells it can be readily understood that its adoption as a fuel is a matter of course. But even if the gas must be previously produced from coal its employment as a fuel is economical where great heat is desired. In Europe the Siemens regenerative gas furnace has been quite largely in use for some years. In this country its use has been more limited. Here in New York and Brooklyn the wide-spread employment of gas as a fuel in the West has produced a very marked effect. New York manufacturers of certain products have found themselves continually undersold. It only remained for them to adopt similar methods, or to retire from business. In order to get the facts in the case of gas fuel, and to learn the position and ideas of Eastern manufacturers in the matter, a representative of the AMERICAN MACHINIST journeyed (on a ferry boat) to Brooklyn, E. D., and visited the "Chrome Steel Works" at the corner of Kent avenue and Keap street, of which Mr. S. H. Kohn is president. Mr. Kohn was emphatic in his praises of gas as a fuel in the making of steel. "In the first place," said he, "by turning coal into gas we can do with less coal. This may sound paradoxical; but, in fact, by this process, 60 pounds of coal will go as far as 224 did before. By employing gas, we do not lose so large a percentage of heat. We can get a higher degree of heat, and we can hold it just where we want it. The furnace has a good deal to do with it. We use a Siemens' furnace. No cold air comes into these furnaces. It is all hot air. Of course, it is an expensive change to alter a large plant. Our melting furnace cost $15,000 when it was built. It would now cost fully $10,000. And now we are changing our heating furnaces to Siemens' gas furnaces, and expect to turn out more and better work. We had to do this to catch up to the Pittsburgh men; and we do not propose to be left behind. Natural gas cannot be had everywhere. Deep as they sink shafts in the California mines, they do not find it. So we must make the gas."

Going out into the melting shop, John Brentano, the foreman, gave his notions of the excellence of the system: "It is not the gas that does the work directly, like oil in a lamp. It is the regenerating of the gas through a lot of brick checkerwork, which is heated by the refuse heat which would otherwise escape into the stack. Every 30 minutes the current of gas is reversed and goes in the opposite direction. It takes 24 hours to heat the checkerwork at each side. Then you can melt ore, if you wish, for 10 months, day and night. At the expiration of this period we must tear out a portion of the firebrick lining of the furnace and put in a new lining. This can be done in two days. It takes 4,000° Fahr. to melt our material—iron, carbon and chrome. We get four times as much force of heat from a ton of coal as in the old process. We formerly used 40 tons of coal a day, and now 10 tons or less suffice for the same results."

Cheap Fuel at Port Huron.

Port Huron, Mich., has oil, salt and natural gas underlying the place and extending nobody knows how many miles. One gas well has been burning for the last three months, and shows no signs of diminished vigor. A company has been formed with $300,000 capital, composed mainly of Pittsburgh men, and has bought 5,000 acres of land around Port Huron to bore for oil and gas. Chas. A. Bailey, of Port Huron, is the largest stockholder. A company is also to be formed to manufacture salt. A correspondent writes to a local paper, the *Sunday Commercial*, that although the company expects to pipe and deliver gas for domestic and manufacturing purposes, they do not occupy the entire field. It only requires drilling about 600 feet to strike a profitable vein of gas. Transportation facilities are ample both by water and rail. The vein of pure rock salt 1,600 feet below the surface is 100 feet thick. He further says:

"What we want are manufactories and men of business to manage them. We have money and land and fuel and all that, but we must have men skilled in all these arts that we wish to profit by if we expect them to be successful ventures.

* * * * * *

"We think that our gas is better as a source of power than a water fall, as it never varies, never has a flood, and never does more damage in a day than can be made up in a month, and is always right at hand ready to use."

The Preservation of Exposed Ropes.

The preservation of exposed ropes is a matter of great importance when scaffolding remains erected for any considerable time, especially in localities where the atmosphere is destructive of hemp fiber. It has been suggested that in such cases the ropes be dipped when dry into a bath containing twenty grains of sulphate of copper per liter of water, and in soak in this solution for four days, afterwards being dried; the ropes will thus have absorbed a certain quantity of sulphate of copper, which will preserve them alike from rot and from the attacks of animal parasites. The copper salt may be fixed in the fiber by a coating of tar or by soapy water. In tarring the rope, it is said to be better to pass it through a bath of boiled tar hot, drawing it through a thimble to press back the excess of tar, and suspending it afterwards on a staging to dry and harden. According to another process, the rope is soaked in a solution of 100 grains of soap per liter of water; the copper soap thus formed in the fiber of the rope preserves it from rot even better than the tar, which acts mechanically to imprison the sulphate of copper, which is the real preservative.—*The Mechanical World.*

We find the following under the head of "Proctor's Points" in the *Dominion Mechanical and Milling News of Toronto:*

"The writer remembers a mechanic who under particularly adverse circumstances, began his apprenticeship in 1881, whose employer, as an inducement to the young man to study, gave him gratis a copy of the AMERICAN MACHINIST, and he began at once to study mechanical points. Chordal was then writing his very interesting notes for the MACHINIST; and our young friend, in studying up Chordal's letters and other matters, was not ashamed to ask questions when he did not understand. He undertook to master along the line of Chordal's suggestions, the relative proportions and advantages of a good engine lathe, and studied on the matter night times until, as he said to himself, 'the lathe became to him, not only as a whole, but in every part and particular of its construction in detail, a regular nest of interrogation points.' That young man to-day is the mechanical superintendent of a large machine works in the West, and is receiving $5 per day for his services, while two or three young men here in the city of Toronto that began their apprenticeship with him, and who had very much superior privileges and advantages, are still plodding away at $1.50 to $1.75 per day, and their wages probably fairly cover their value as mechanics to the firms who employ them."

The evening school for apprentices and workmen, conducted in connection with the shops of the Burlington, Cedar Rapids and Northern, at Cedar Rapids, Ia., under the charge of Master Mechanic R. W. Bushnell, is flourishing and is producing most excellent results.—*Railway Review.*

The Aultman-Taylor Company, of Mansfield, Ohio, had a convocation of injector men at their shop recently to compete for orders to supply their portable engines. We have not heard the result.

Fixtures for Making Twist Drills on the Universal Milling Machine.

BY FRED. J. MILLER.

Various conditions may arise in most shops which render it desirable to make small twist drills in moderate quantities with at least some approximation to the prices at which similar drills may be purchased.

Any shop having a universal milling machine can undoubtedly do this by taking the little trouble necessary to "rig up" so as to make the best possible use of the machine. If drills are to be made at an economical rate the milling of the spiral grooves must be done rapidly enough to make it necessary to support the drill at all times directly under the cutter, so as to prevent all springing of the drill blank; and things must be so arranged that there will be no tendency for the cutter to lift the drill from the rest, either at starting the cut or at any other time; for if there is any such tendency it will be found rather an arduous undertaking to counteract it by pressing the blank down with the handle of a brush, as has been suggested.

Then, too, a chuck will be needed, which will hold the blanks much more securely than most chucks can be made to hold.

For this purpose the one shown in Fig. 1 can be recommended; the spring collets for which, shown by Fig. 2, should be made with a hole through them just the size of the drill to be held. They should be given a spring temper, and the lower end of the nut, and also the end of the body of the chuck where the collet comes against it, should be tempered.

This chuck, when well made, is excellent, not only for the purpose for which it is here shown, but for use in the drill press as well, and may be provided with a collet long enough, so that no more of the drill may project from the chuck than is necessary for the depth of hole to be drilled.

The next thing is to provide a rest which will always support the drill blank directly under the cutter, and allow no yielding of the blank, no matter how heavy the cut, nor how fast the feed may be.

A rest which seems to fulfill these conditions perfectly is shown by Fig. 3, in which *a* is a casting fitted and bolted to the platen of the machine in the same manner as the regular rest; *b* is a piece of steel having its upper face provided with a V groove in which the drill blank rests.

It is fitted into *a*, and is slotted where the screws *c* and *d* pass through it, so that it is free to move vertically at either end, except when the screws *c* and *d* are tightened. It will be seen that the piece *b* may be set at any angle within certain limits, as well as adjusted for height, which makes the rest useful for many purposes. The facility with which it may be adjusted to support any slender piece of work for a considerable portion, if not all of its length, and inclined either way to support taper work held between the centers, or anything held in the chuck at an angle, either above or below the line of centers, makes it, though simple and strong, almost a universal rest. Its base should be arranged, as shown, so as to form a basin for the reception and disposal of oil and chips. This feature should always be looked after in the designing of milling machine fixtures, because when milling steel, such an abundance of lard oil should be used upon the cutter as to make it necessary to catch and use it repeatedly.

The way things look when rigged up is shown by Fig. 4, the spiral head being elevated about one-half degree, to make the center of the drill the thinnest at the point, and the grooved piece *b* of the rest adjusted so as to support the drill its entire length.

Now, if the motion of the machine be reversed, and the cutting commenced at the upper end of the groove, and feeding out to the end, it will be found that there is no tendency to lift the drill from the rest, and things may be crowded up to the limit of the capacity of the cutter.

When milling work having only two grooves, a considerable portion of the time is consumed in indexing, since the index pin must be turned twenty revolutions to turn the work from one groove to the other. Most of this time is saved by the use of the collar marked *c* in Fig. 4. It is made to turn freely upon the collar which screws on the spiral head spindle, and is held in proper position by the milled head-screw, as shown. It is provided with four numbered lines or graduations, 90° apart, which, when the spindle is revolved, successively come opposite a mark placed upon the spiral head, and thus indicate when the spindle has been turned one-fourth, one-half or a complete revolution. If, in starting the first cut, one of these lines upon the collar be brought fair with the line upon the head, then in starting the second cut it is only necessary to bring the opposite line into the same position, so, in running back after taking the first cut, the index pin is left in the plate until the desired line comes into position, when the pin is pulled out from the plate, and held in the right hand, while the backward motion of the slide is continued, until it is arrested by the stop. The pin can then be put into the proper hole, and the work is indexed without loss of time, and without liability of mistakes made in counting.

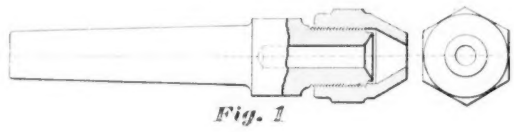


Fig. 1

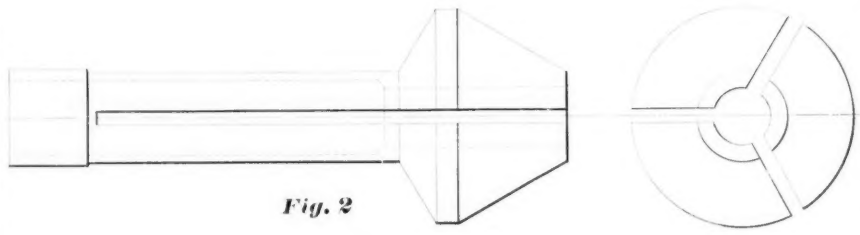


Fig. 2

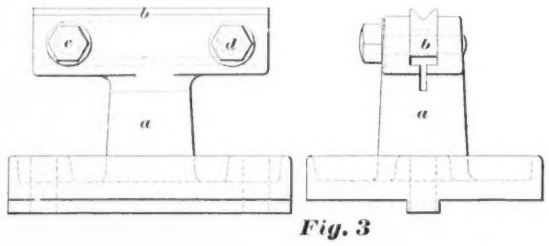


Fig. 3

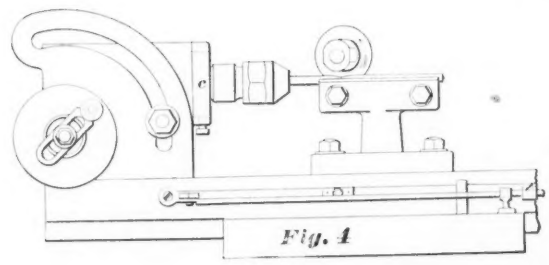


Fig. 4

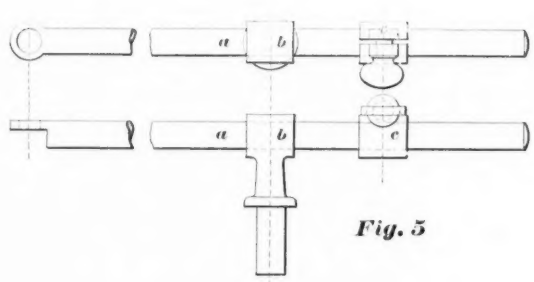


Fig. 5

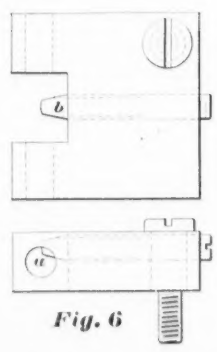


Fig. 6

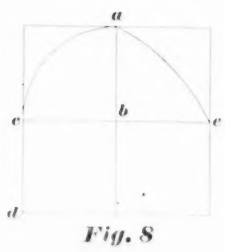


Fig. 8

Fig. 7

When the motion of the machine is reversed, something is needed for throwing out the feed at the end of the cut. For this purpose the device Fig. 5 is presented. The piece of polished drill rod *a* is flatted and drilled at one end, and is fastened by a screw to the underside of the lever by which the feed is manipulated, the other end sliding freely through the stud *b*. The clamp collar *c* may be tightened upon the rod at any point, by the thumb screw, and when, by the backward motion of the slide, it comes in contact with the stud *b*, the lever is drawn forward, and the feed thrown out.

When fixed up for the work in this way the machine will be found very effective since the cutter can be sunk into the blank the full depth at once, and only one cut taken in each groove, and that one at a rapid rate. In this way drills .225" diameter and with grooves $3\frac{7}{8}$" long have been milled at the rate of 170 per day. The advantage of having things fixed up solidly for such work was plainly shown when a lot of $\frac{3}{8}$ drills were wanted, and two machines, one small and the other the large back-geared machine, were rigged up for the job. The small machine ran at a speed of 60 revolutions per minute, and the large one at 68. The arbors were the same size, and yet, notwithstanding the higher rate of speed at which the cutters ran in the large machine, they invariably ran longer and did considerably more work at one grinding than when used in the small machine, and the cutters were frequently interchanged without altering the result.

This can only be attributed to the fact that the outer end of the arbor is supported in the large machine, and that the entire machine is much heavier and better able to absorb vibrations. This would almost seem to indicate that no matter how rigidly we may seem to have things fixed, there is an advantage to be gained by having them still more so.

Fig. 6 shows a device by which the drills may be backed off very rapidly, and in good shape.

It consists simply of a flat piece of steel provided with a hole *a* just large enough for the drill to slide through easily. As the drill is pushed through this hole the edge of the spiral groove comes in contact with the end of the screw *b*, which causes the drill to rotate, then an emery wheel is so adjusted as to come in contact with the drill through the square opening shown.

The device may be fastened to the ordinary flat rest of a grinder by the screw shown, and upon which it swings against a stop pin.

Though many twist drills are seen having curved cutting lips, it is not generally considered a desirable form, and the "straight lip" drill is usually much preferred.

If the angle of the spiral be 20° and of the lip of the drill 30°, and the thickness of the drill at the center $\frac{1}{10}$ of its diameter, all of which are probably pretty near what they should be, then the form of cutter shown by Fig. 7 will produce a straight lip drill. Referring to Fig. 7 and letting *D* represent the diameter of the drill, then

$r = .375$ D.
$R = .838$ D.
T = R = thickness of cutter.

A convenient method of obtaining this form is shown by Fig. 8. A square is drawn, one side of which equals $\frac{3}{4}$ of the diameter of the drill, then divide the square into four equal parts. The point *a* is where the arcs which form the shape of the cutter unite; *b* and *d* are the centers from which the arcs *a e* and *a c e* respectively are described. These arcs are the nearest approximations to the true curves, which were developed by Mr. Chas. A. Bauer, to whom the craft is indebted for this presentation of them. I infer from his remarks that the development of these curves will prove quite an interesting study for those who are fond of such things, and that it is not nearly so simple as it seems at the first glance.

With this cutter and the other devices which I have shown, twist drills, admirable in every respect, may be made at a rate which will often be surprising.

We learn that the ice crop in Maine and the alligator crop in Florida are both very promising.

LETTERS FROM PRACTICAL MEN.

The Depp Motor.

Editor American Machinist:

In a recent issue of the AMERICAN MACHINIST I noticed an article on the Depp Motor of Sedalia, Missouri. I was one of the committee during the trial and test of the motor; it is a complicated affair; the principle is this: Steam is taken from the boiler and operates a steam air pump. From the exhaust of pump the steam passes through a coil back of the bridge wall and is superheated, and then to engine. The trial was made at Sedalia, at Mr. Kippings flour mill; engine 45 indicated horse-power at 100 pounds steam. During the trial in which a saving of 25 per cent was claimed the engine only developed 32 horse power as per indicator.

The gauges stood, boiler pressure 110 pounds; steam pipe between steam pump and engine 80 pounds; on pipe from air pump to boiler 115 pounds. The air taken to boiler passed through a coil back of furnace before entering boiler from top. Two revolutions of the steam cylinder equals one of the engine. Air cylinder water jacketed and water taken through air pumps for boiler; supply steam had to be carried at 125 pounds.

If there was a saving of 25 per cent. the committee failed to find it, and surely the stockholders would like to know it.

E. U. C.

Welding Compound.

Editor American Machinist:

The following is found to be an excellent compound for welding steel. High grade steel can be welded by the use of this better than with borax, because it is not necessary to heat so high. The pieces should be held together when heating:

Copperas, 2 ounces; saltpeter, 1 ounce; common salt, 6 ounces; black oxide of manganese, 1 ounce; prussiate of potash 1 ounce. These should be pulverized and mixed with 3 pounds of good welding sand, the mixture being used the same as sand. C. E. K.

Tempering Locomotive Springs.

Editor American Machinist:

In answer to L. A. W., Questions and Answers 435, as to the best way to temper locomotive springs, let him take the following precautions, and make a bath of 6 gallons lard or fish oil, 1¼ pounds gum arabic, and ¼ pound rock salt. Mix well when it is ready for use. Heat the steel to a dark cherry-red, cool and draw no temper. He will find no trouble if the steel is properly manipulated.

GEO. JONES.

A Disclaimer.

Editor American Machinist:

In editorial comments on the Mechanical Engineers' meeting, in your issue of Dec. 25th, referring to a discussion of a paper on "The Labor Question," you say that "during the discussion remarks were made reflecting upon the honor of workmen. In conclusion, Vice-President Towne very emphatically took the opposite view," etc., etc.

The remarks in question were read from a written discussion of Mr. Partridge's paper, prepared by the writer, now on file in the records of the society, and which will appear in the "Transactions" verbatim. Mr. Towne, in an aural reception of the points desired to be made in these remarks, very evidently misapprehended their drift and tenor. There is certainly nothing in them that can be so construed, and it was furthest from the writer's intention to convey any such impression.

As Mr. Towne closed the debate with his remarks, the writer had no opportunity to correct the impression verbally, but has availed himself of the privilege accorded by the society in such cases, of placing in the "Transactions" a rejoinder to Mr. Towne, showing that he had misapprehended the discussion as rendered.

No sane man will contend for a moment that there is no such thing in existence as a dishonest workman. We know, too well for society's well-being, that there are dishonest people in all walks of life; and I believe it to be true that there are less of them, in proportion, in the humbler than in the higher ranks.

If anything in the remarks in question can be construed as touching upon the honor of workmen, there certainly is nothing therein which even hints in the remotest degree at such a proposition as that the average workman is dishonest.

I believe that there are exceptional workmen who are dishonorable in their dealings with employers, and I equally firmly believe that there are employers who are dishonorable to employes. Human nature must be different if there were not; and perhaps one sentence in the remarks alluded to might be taken to indicate this, but that there was anything contained in them that can be tortured into a reflection upon the honor of workmen in general I most emphatically deny; and I think Mr. Towne will admit, upon a careful perusal of the discussion, that nothing of the kind appears therein, either directly or by implication.

JOHN T. HAWKINS.

Taunton, Mass.

A Needed Railroad Reform.

Editor American Machinist:

Your correspondent has noticed with alarm and shame the growth of a railroad evil that is getting to be worse than strikes, pools, etc. I refer to the general growth of railway lies and the total eclipse of truth in the business relations of the road service between officers and employes. Officers have discharged and suspended men for slight offenses or mistakes until the men, in sheer self-defense at first, would handle the truth a little careless to get out of slight scrapes until it has come to be recognized as the truth that any statement made by an engineer or conductor in reference to accidents can be simply set down as a lie.

Officers often make rigid inquiry into accidents to find and remove the cause, but when men will tell the opposite of the facts the real cause is often left to do more damage. Railroad officers in many cases enquire just enough to settle the blame on some employe and off of their management, and the best of their men are often impaled on their merciless ire for the slightest of causes. This has made liars of a majority of an army of skilled laborers. One good single-handed liar on a division of a railroad can make a master mechanic distrust every plug puller from the "pony" to the pay car engine. Why, I know a young engineer, who, on his maiden trip, made a fly run into a siding through four feet of snow, and telescoped six empty box cars that were standing thereon, and, on the advice of two older engineers, made out his report that "he coupled into the cars and pulled them to pieces, trying to get them out of the siding." This report was sent back from the superintendent's office, with doubts and a request for a bill of particulars. Then he cleared the matter up by explaining that he "had just got them started, when a draw head broke, and 'he threw her over' to stop, and the slack piled them up." This was the man's written statement, and was, of course, perfectly satisfactory to the superintendent (?); but I noticed that the said young man fired over two years more before he was given any more "slack" to take care of. Had he told the truth, that he went into the siding fast, to clear the snow, and did not see the cars in the storm, I doubt if he had got more than a warning to "be careful."

I know of but one remedy, and that is to "swear off." Let every man on an engine make his word good, his reports—verbal or written—the absolute truth, and resent the insult when it is doubted, let the doubt come from high or low, and it would not be long till there would be less doubts, and some good done by accidents, in experience as to the best way to avoid them. It makes a man hate his mother to make out a true report of an accident and know that his superior officer will only read it as a matter of form, and all the time is thinking, What a gifted liar the cuss is.

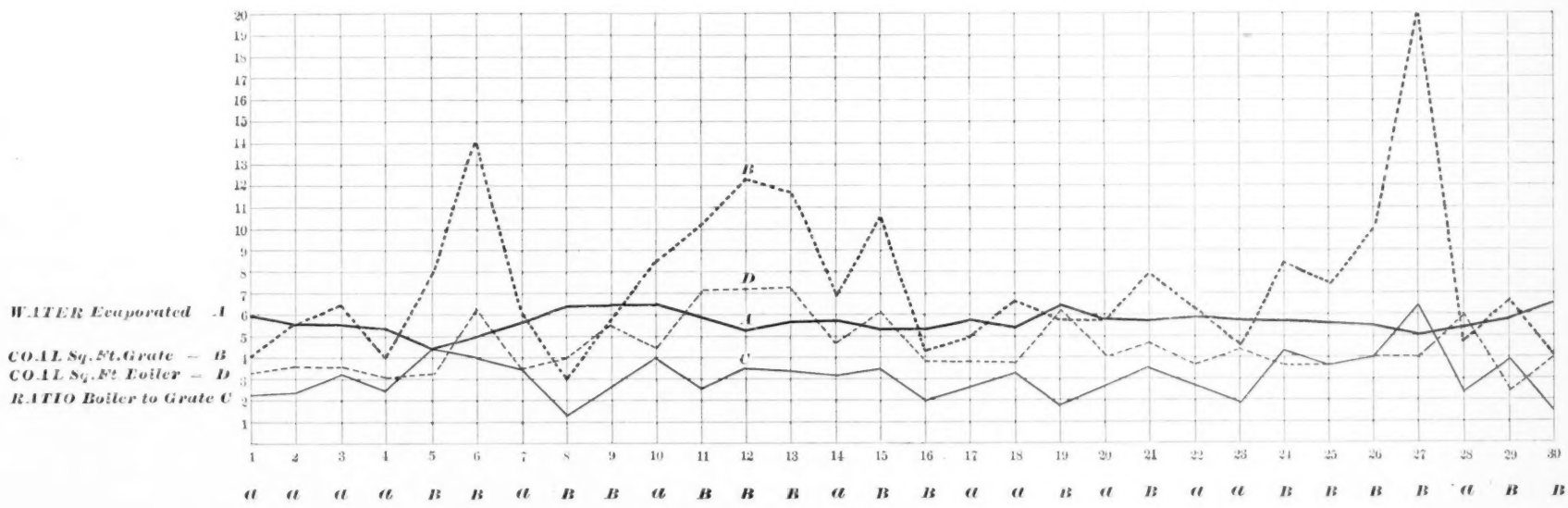
JOHN A. HILL.

Pueblo, Colo.

There are nearly or quite a hundred places in the Black Forest, Germany, where the manufacture of clocks and watches is the principal industry. This accounts in part for the unusual number of German clocks.

Evaporative Tests of Water-Tube Boilers.

BY JOHN A. CALDWELL.



The chart of lines submitted may be described as follows: The ordinates from one to thirty represent thirty tests for evaporation of water from as many water-tube boilers, the tests being made at different places, times, and by different engineers. The position of the cross lines on any given ordinate indicate amounts as follows:

Line *A*—The number of pounds of water evaporated from and at 212° per pound of combustible burned on the grate, each vertical space measuring for line *A* = 2 pounds.

Line *B*—The pounds of combustible burned per hour per square foot of grate surface, each vertical space measuring = 2 pounds for line *B*.

Line *C*—The pounds of combustible burned per hour per 10 square feet of heating surface, each vertical space representing only 1 pound in the case of line *C*.

Line *D*—The ratio of heating to grate surface, each vertical space representing 10 square feet for line *D*.

The lines, although measurably correct, are meant to show proportions rather than definite amounts.

The letters *a* and *B* at the foot of each line tell the kind of fuel used during the test; *a* standing for anthracite, and *B* for bituminous coal.

For example on test number 12 the ratio of heating to grate surface was 73 of heating to 1 of grate. The pounds of combustible burned per hour per square foot of heating surface was .34 of a pound; the pounds of combustible burned per hour per square foot of grate surface was 25, and the pounds of water evaporated was nearly 10½, &c.

The lines show with startling clearness that a given proportion or ratio of heating to grate surface will not by itself result in a certain definite measure of evaporation of the water in the boiler.

It will be noticed that line *B* goes up quite high at ordinates 6, 12, 15 and 27, indicating a strong fire during the particular tests that those ordinates stand for, but it will also be noticed by inspecting line *A* at those same ordinates that the strong firing had not the effect of producing a high evaporation, but rather the opposite. On the other hand, when line *B* falls as at 8 and 30, the line *A* shows to good advantage indicating as high as 12.49 and 12.62 pounds of water evaporated per pound of combustible.

Ordinates 9, 10 and 19 also show high evaporation without the necessity of line *B* being low. This is particularly the case at 10 and 19. Briefly, a slow fire at 8 gives high evaporation, while a strong fire at 10 gives a trifle better result.

At the points of highest result on line *A*, viz.: 1, 8, 9, 10 and 30, all the other lines occupy lower places on the ordinates, with exception of 10. This would seem to show that a medium fire, with medium or low ratio of heating to grate area, say 30 to 1, was good practice. On the other hand the fact that the lines cross and recross each other, no two lines rising and falling uniformly shows that it is quite difficult to predict what the results will be from any given furnace or boiler. Suggesting that the draft, the firing and the degree of dryness of the steam, all play a considerable part in the resultant evaporation, I submit the above chart in hope that it may lead to a discussion among your readers as to the proper proportion of grate area to heating surface in a water tube boiler; also different modes of firing.

The Worcester Institute Machine Shop.

In the Worcester Free Institute of Industrial Science students are instructed both in the wood working and machine shops, in doing work to obtain commercial results. On a recent visit to the workshops of that institution we were impressed with the good condition in which all the machines and tools both large and small are kept, and the careful attentive way in which the students were doing work. Several thousand dollars worth of the products of the machine shop and wood working shop are sold every year. Every student in the mechanical engineering course practices ten hours a week in the machine shop under the direction of Superintendent M. P. Higgins. He begins work at 1 P. M., and continues until six. Next day he begins work at 7 A. M. and continues until twelve. The first job a student does is to take a forged hexagon head-bolt, center it, square up the ends, turn it to a fit and thread it. These bolts are used in the machinery built in the shop, and must be well finished. The next job is a more difficult one, and by gradual progress the students learn to do work that would surprise mechanics who have not observed the methods of instruction in this institution. Students are led to design as well as to construct, and their capacity for original mechanical thought is well tested. We noticed some machinery built by students of the senior class in this shop that would be creditable to any machine shop in the country. At every step the students are impressed with the necessity of doing machine work with thoroughness and accuracy, so that after graduation they will not have to unlearn any part of the knowledge there acquired.

The government is in possession of ample means, and every intelligent citizen knows that there is vital necessity for improving its coast defences. Put these conditions together in business, and how long would a business man be in moving in the matter? But large bodies, especially political bodies, move slowly, or not at all. Bringing about provision for coast defence is, on a large scale, a case similar to that of the attempt of the committee of the Society of Mechanical Engineers to get action on the part of Congress upon testing constructive materials. The lawmakers admitted the advisability of action, but one of them gave away the whole matter when he said there was "no politics in it." And that is just the trouble with the question of coast defences; there is no politics in it. Let either of the great political parties oppose it as a matter of policy, and work will be begun without serious delay. Our astute lawmakers see no occasion to do anything that all the people are agreed upon.

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NEW YORK, JANUARY 8, 1887.

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Educational Workshops.

In these times, when technical schools are giving a good deal of attention to the workshop part of the course, it is possible that the importance of seeing that the shop methods practiced are the best in their way is not always fully appreciated. Boys in the technical school are just as likely to be influenced in this respect for good or bad as boys in the school of regular shop work are, and the influence of bad examples is just as likely to make a permanent impression in one instance as in the other. But the necessity of a good example in the technical school is greater than in the shop, because the presumption, at least, is that the college graduate will employ himself in directing the efforts of others. To some extent he will then be a teacher with its added responsibility.

We do not mean that the college workshop should necessarily be equipped with all the approved special labor-saving tools of the modern machine shop. This would be impracticable, and generally such tools would be, by far, in an educational point of view, the least valuable part of the equipment. It would many times be better that the student do the work by hand, to use an ordinary shop colloqualism, than by the aid of tools and appliances that relieve him of the necessity of thinking and exercising skill, which is one thing he is supposed to be cultivating. But whatever the tool he uses he should be taught to use it to the best possible advantage, and not allowed to drift into a slip-shod way of handling it.

In the workshop the college student is supposed to be preparing for one of the most important problems; one always confronting him, which will be, given certain ends to be accomplished, with certain means which may be used for their accomplishment. It follows that the highest measure of success will attend him who has best learned to adapt the means—whatever they may be—to the end. There is no better training in this respect than machine shop practice, and it is not necessarily less valuable because the tools are not always best adapted to do the work attempted with the greatest degree of commercial success. The important point is to learn to skillfully and successfully use the best tools at hand for the purpose. To illustrate, it may be necessary to, so to speak, turn a shaft on the planer; then the important thing is to come at it in such a way as to do it quickly and well, considering the means. It is according to all machine shop observation that the young man who has learned to make the best possible adaptation of tools in a shop not well provided, will have no serious difficulty in using more appropriate ones when he has the opportunity. If he has not learned this his time has been much worse than thrown away; it does not matter whether the shop he learned or failed to learn in is in a college or somewhere else, or whether he continues to work with the tools or to direct others. Although practice in the educational workshop is perforce, limited, it is possible if the methods are not carefully looked after, that a good deal may be learned that is positively bad, and that will not be readily unlearned.

The general arrangement of everything in such a shop should be as good as that in the best manufacturing shop in the country. Shafting out of line and heating in the bearings, pulleys wobbling around with an apparent tendency to go in any direction but peaceably around, and tools dirty and bearing evidence of misuse are painfully out of place in an educational workshop. No "awful example" of any kind ought to be tolerated. The tendency of such things is to cultivate carelessness, or worse even than that a belief in things wrong in themselves.

The tools in the college workshop may be few, but they should be good of their kind, and well kept; the shop may be small, but everything about it from the little engine that drives it to the last cold chisel should be in condition to afford a lesson in good practice. Failing in these it is difficult to see how it will accomplish any good; in fact it is difficult to see how it will fail to do positive harm.

Political Mechanics.

The Machinists' Union of New York and Brooklyn has petitioned Secretary of the Navy Whitney, first, to have some of the new vessels of war built at the Brooklyn Navy Yard, and second, to have him require the superintendent of that yard employ only mechanics who are skilled in the work to be done, instead of political heelers. The petition should be turned bottomside upwards, so that the second part will come first. Until the political heelers in the navy yard workshops give place to thorough mechanics who will work as they do in private shops, it would be a waste of the people's money to build new vessels at the yard. It will, however, take something stronger than petitions to effect such a change. Just before the election last November about 1,400 men were employed at the Brooklyn Navy Yard, being the largest force in several years. But before December more than half of them had been discharged. The reason given for this sudden decrease of force was the old time-honored one: lack of appropriations to carry on the work. A reporter of the leading Brooklyn daily paper, who made inquiries of the officials at the yard, was told that the papers publish too much about matters in the Navy Yard. These officials may feel too modest to be publicly discussed, but they are not at all retiring, although that is just what they should be.

The Motive Plants of Manufactories.

In starting a new manufactory the motive plant generally receives scant consideration. The total energy in the way of planning is frequently so far expended in planning other features that when it comes to what is to set the machinery in motion there is none left. It is frequently possible to go back further than this and find that when the plan for the building was under consideration the space for the boilers and engine was not allotted from any particular regard to the requirements; such room as could be conveniently spared was devoted to this purpose, and probably, later on, a part of this is appropriated for other purposes. The problem is, in the end, to get two hundred horse power in engine and boilers in one hundred horse-power of room. Not long since we listened to much discussion of how to do this in the instance of a new plant, and finally something different from what was desired in the way of boilers and engine was put in. The motive plant will never be satisfactory, because it is not what was wanted.

The motive department of a manufactory receives, as a rule, scant consideration after it is established. Right there is the beginning of economy in manufacturing, and the most successful of our large manufacturers understand this. But too many give it but little attention, and the result is sometimes disastrous. Many promising concerns have come to grief through failure, first, in not providing a proper motive plant, and, second, in not placing a good man in charge of it, and giving him an opportunity and an incentive to run it in the interest of economy, which means a good deal more than the cost of the coal burned.

What is needed in the motive plant is room and light, good boilers and engine, and a man in charge who knows what a ton of coal costs, and particularly one who knows the cost of enforced stoppages and unsteady speed, and that the loss from a break-down may be a hundred times greater than the mere cost of repairs. The condition of the motive plant ought to be a good index of how the entire business is conducted.

The shingle manufacturers recently met at Grand Rapids, Mich., and discussed the advisability of forming an organization to control prices. The meeting adjourned to Feb. 16th. This seems to be a good commercial movement, and nothing has been published against it. Suppose now that all the shingle workers should form a union and take steps to control prices of their labor; would the movement receive a like approval?

Private Gas and Water Supply.

It is said that the city charter of Grand Rapids, Mich., will probably be amended so as to permit the sale of the present water works to a private corporation, and two syndicates of capitalists as it stands are ready to make an offer. The tendency to sell or lease water works and gas works belonging to cities is unfortunately a growing one. When it becomes necessary to make improvements or additions to the water or gas supply, the people who pay taxes in some cities seem to be appalled at the great expense necessary to carry out the project. It is then that some syndicate comes forward with an offer to take control of the works, make the improvements and run the supply business for a term of years. The scheme seems to promise relief from taxation for gas and water supply, Generally the bait is too alluring to be resisted, and the syndicate gets control. Soon the people discover that they are paying a high price for a poor water and gas supply and that they have no power to remedy it. The syndicate has no soul, and its great object is to make dividends. Once rooted and grounded with a valuable franchise it can laugh at citizens who talk of compelling it to carry out its promises. The people find that they are taxed by a private concern which is virtually irresponsible to them for the exercise of its powers, and that they are paying more and receiving less than they would pay if managing their own gas and water works.

It is seldom that a gas company or a water works company in a city fails to pay a good dividend, besides paying a higher rate of interest on bonds issued to raise money for construction than the city would have to pay if it owned the works. Cities can obtain just as honest and efficient engineering talent to manage public works economically as can private companies, and the people should have the benefit of the profits as well as the full control of their own gas and water supplies.

Marine Engineers' Beneficial Association, No. 50, will tender a grand complimentary ball to the delegates attending the National Association Convention to be held in this city, January 10th to 14th. The ball will take place at Lyric Hall, Sixth avenue, between 41st and 42d streets, Thursday evening January 13th.

A correspondent is desirous of knowing something that will remove the coating formed by borax or other welding compounds on the polished steel of carriage axles, without filing or using emery.

Some of our industrial contemporaries are urging the profit sharing plan upon manufacturers as a sort of preventative of labor troubles and an incentive to workmen to do their level best. A few days ago a Western manufacturer who employs about four hundred hands and who has tried the profit sharing plan for the past year, called at our office. He was about to divide $15 000 among his employes as the result of the promises he made a year ago, and said that the system did not secure any better service nor show any advantages in his business; except in the case of a very few workmen the plan did not seem to have any effect. He will not continue another year. He never has had any labor trouble in his shop, so the system produced no change in that respect.

The *Sun* has interviewed, or been interviewed by—exactly which is not clear—an engineer who predicts that the locomotive of the future will have four cylinders (not compounded) instead of two. It is claimed that the effect of coupling the wheels in the usual manner is responsible for a large percentage of the total friction of the engine, which would be avoided by using a pair of cylinders for each pair of wheels. We opine that the friction introduced by the extra pair of cylinders would be greater than that avoided, and that unless it is in the instance of compounding, the value of which for locomotives is questionable, there would be a very materially greater loss from condensation in multiplying the number of cylinders.

The proper proportion of grate to heating surface in a boiler is one of the things that are fixed quite readily by writers on the subject, but one thing always seems to be left out of consideration; that is this: With one grate bar the percentage of opening for air may be, and frequently is, not much more than 30 per cent. of the total grate surface, while with another one it may be 70 per cent. Coal cannot be burned unless air can be got to it, so it is reasonable to suppose that there should be some relation between air space and heating surface as well as, or even more than, between total grate surface and heating surface. If this is not so then it must be concluded that the capacity of a boiler is largely dependent on the kind of grate used.

Another thing that has an important bearing on the quantity of coal that can be burned in a given time on a given grate surface is the distribution of air spaces. These should be numerous rather than few, so as to bring about intimate mixture of air with the fuel, both for rapid and economical combustion. This is essential without reference to the actual proportion of air space to total grate area; exactly what the latter should be is a subject worth more attention than it has received.

For the second time since the opening of the 49th Congress, Col. Morrison has been defeated in his efforts to bring up a tariff reduction bill. He gave up the horizontal plan of attack some time ago. That was defeated in the 48th Congress by a majority of three. His new tariff bill last winter encountered an adverse majority of seventeen, and his last attempt to bring up a reduction bill was defeated by five majority. It is certain that if a vote had been taken upon passing the bill, instead of a motion to debate upon it, several members who were recorded in the affirmative would then vote in the negative. Morrison might obtain votes enough to bring his bill up for discussion, but cannot get a majority to pass it. When the tariff is revised, it should be done by the friends of protection—not by its enemies.

Examinations at the different navy yards reveal the fact, which every one knew before, that there are enough of some supplies at one yard to last for years, or up to a period when their use will be discontinued to make room for something better, while at the same time at other yards such supplies are being purchased. This is leading to the sensible conclusion that one of the yards should be made the base of supplies for the others. The trouble will come when the decision as to which one shall be the distributing yard is made.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(6) N. S. I., Paterson, N. J., will find the matter in relation to blue prints, to which he refers, in the AMERICAN MACHINIST of July 31, 1886.

(7) G. L., Cincinnati, Ohio, asks: Can as much steam be raised with the water from condensed steam as with water never before used for making steam? *A.*—Yes.

(8) H. J., Racine, Wis., asks: If a fire-engine is working through 300 feet of hose, and a gauge is attached two feet from the nozzle and another four feet from the engine, which gauge will show the most pressure? *A.*—We understand the pipe to be horizontal, and that the pressure will be greatest near the engine, due to the friction of water in the hose.

(9) C. F. & Co., Boston, asks: What is the safe working pressure for an upright boiler, just built by one of our best builders, the shell being 34 inches diameter, of ¼" steel, 60,000 lbs. tensile strength. The shell is made in one sheet, vertical seam, double-riveted; the furnace double-stayed, stays screwed and riveted. The boiler has been tested to 150 lbs. hydrostatic pressure? *A.*—According to U. S. inspection laws, if the holes for the vertical seam of such a boiler are drilled and reamed, and the construction is such otherwise as to be as strong or stronger than this seam, the boiler would be passed for a pressure of 175 lbs., being previously tested to a pressure 50 per cent. higher than this. We should say, if conscientiously built by an intelligent boilermaker, that 150 lbs. would be a very satisfactory and safe pressure.

(10) D. C. S. writes: Is there a rule to determine the number of plates in a half-elliptic spring, capacity, size of steel and span being given, or size of steel, capacity and number or plates given to find the span. Example: How many plates are required in a half-elliptic spring 30 inches long; steel, 3"x⅜"; capacity, 18,000 lbs. *A.*—1. Multiply the capacity in tons of 2,240 lbs. by the span in inches, and by 11.3; call this "product A." Multiply the breadth of plate in inches by the square of the number of 1-16 inch contained in the thickness of one plate; call this "product B.' Divide product A by product B; the quotient will be the number of plates required. Example; Capacity is 18,000 lbs. = 8 tons; span, 30 inches; and steel, 3' x¾".

$$\frac{8 \text{ tons} \times 30 \text{ inches} \times 11.3}{3 \times 6^2} = 25 \text{ plates.}$$

2. To find the span when the number of plates, size of steel and capacity is given. Multiply the number of plates by the breadth of plate in inches and by the square of thickness in 1-16 inch; cal this "product A." Multiply the capacity in tons by 11.3; call this "product B." Divide the product A by the product B; the quotient will be the span in inches. Example: Number of plates, 25; steel, 3"x¾"; capacity, 18,000 lbs.

$$\frac{25 \times 3 \text{ inches} \times 6^2}{8 \text{ tons} \times 11.3} = 30 \text{ inches span.}$$

By span is meant the distance from center to center of spring hanger.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

N. B. Non-breakable Drills and Taps. A. P. Brown, 108 Liberty st., N. Y.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Mechanical and Patent Office Drawings executed at reasonable rates, by A. Mugford, Hartford, Ct.

20", 25," 28" B G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

Ice and Refrigerating Machines. 120 built, and all successful, by David Boyle, 521 Monroe, Chicago, Ill.

20,000 addresses of steam users and users of mach. in 10 States, $10. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co. 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Machinists' supplies, brass goods m'f'rs supplies, polishing materials, all kinds wire, metals, etc; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

Handbook on the Care of Boilers. 50c. Descriptive Circular and Catalogue of Books for Mechanical Engineers free on application; special terms to Mechanics' Libraries. E. & F. N. Spon, Publishers, 35 Murray st., New York.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price, $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES

S. R. White & Co., Norfolk, Va., will rebuild their iron foundry just burned.

The new refinery of the Standard Oil Company, Franklin, Pa., will cost $250,000.

The Western Knitting Company, Detroit, Mich., will erect a factory, to cost $20,000.

The Brush Electric Light Company, Detroit, Mich., will erect a $26,000 foundry.

The L. B. Flanders Machine Works, of Philadelphia, issue a neat calendar for 1887.

It is stated that Mr. Henderson, of Cincinnati, O., will erect a stove foundry at Spring City, Tenn.

Sol. D. Black, Camden, Ala., will erect a factory for the manufacture of cotton and woolen rope and yarn.

The Peninsular Car Company, Detroit, Mich., will erect a $10,000 shop as an addition to their works.

Ludwig & Smith have bought the Carolina Foundry at Hickory, N. C., and will, it is said, enlarge it.

The additions and improvements to the Philip Best Brewing Company, of Milwaukee, will cost $350,000.

The Knights of Labor Co-operative Soap Company has been incorporated in Chicago, with $250,000 capital.

J. S. Westbrook, John Moffett and E. D. Taylor, of Selma, Ala., will start a carriage factory at Meridian, Miss.

Boomer & Chapman, Detroit, Mich., will erect a two-story factory, to cost $22,000, corner Harper and Lincoln avenues.

Henry J McGuckin, 1232 Third avenue, New York, will erect a $29,000 factory on Avenue A, corner 73d street.

E. P. Allis & Co., Milwaukee, Wis., will build a 40x26-foot addition to their machinery establishment, to cost $5,000.

The shops of the Gulf, Santa Fe and Texas Railroad will be erected at Cleburne, Tex. Ground has been purchased.

J. R. Planten, 104 South Elliott place, Brooklyn, will erect a six-story factory at 231 William street, New York, to cost $19,000.

The Nashville and Florence Railroad will build repair shops at Sheffield, Ala. They will extend their road to St. Joe, Tenn.

The Merchants and Mechanics' Association, Columbia, Tenn., have raised $32,000 to secure the erection of an iron furnace.

Two five-story brick factories, to cost $40,000, are to be erected for Mrs. C. Walters on 109th street, near First avenue, New York.

One of the large shops of the Chicago, Burlington and Quincy road at Aurora, Ill., was recently burned, causing a loss of $30,000.

Oscar Lynch is organizing a company at Fort Worth, Texas, to manufacture iron and wooden bridges. The capital stock will be $100,000.

The D. Bradley Manufacturing Company, 63 Fulton street, Chicago, will erect an addition to their factory, 60x100 feet, two stories high.

Perry & Co., Albany and Sing Sing, N. Y., have contracted to have stove works erected in South Pittsburgh, Tenn., to employ 500 to 1,500 men.

Warren Springer, a well-known machinery dealer in Chicago, will erect a five-story factory at 200 South Clinton street, in that city, to cost $45,000.

John Touhill & Sons have commenced operations in their new foundry and machine shop in Pittsburgh. They will make mine machinery a specialty.

The contract has been let for the $60,000 factory building to be erected in Brooklyn for Oxley, Giddings & Enos, manufacturers of gas fixtures, New York city.

E. R. Chapman, 26 Broad street, New York, and others, have purchased a large tract of coal and iron lands in Tennessee, and propose to erect two iron furnaces.

The Latrobe (Pa.) Board of Trade wants the Pennsylvania Railroad Company to locate its new car shops at Latrobe. The ground on which to build the shops will be donated.

Fox & Endlich have received the contract to erect the new car shops for the Cornwall Railroad Company at the Union Canal basin, Lebanon, Pa. Work will be commenced at once.

The Elyton Land Company, of Birmingham, Ala., declared a 25 per cent. dividend December 9th, making 35 per cent. this month, and 240 per cent. so far this year on a capital of $200,000.

The Orrville (O.) Machine Company has resumed operations under a new management, after a year and a half's idleness. They employ 50 men, and make the Champion thresher and clover huller.

The Gainesville Furniture and Wagon Manufacturing Company will erect a furniture and wagon factory at Gainesville, Fla. W. H. Robertson is president. The capital stock of the company is $25,000.

The Boston and Lowell road have decided to double the capacity of the round-house at Woodsville, Mass., making room for 20 engines instead of 10. The company also talk of enlarging their repair hsop there.

A new industry is about to be established in Fitchburg, Mass., by the recently-organized Fitchburg Manufacturing Company. The company's specialties will be steam engines, small electric light plants, etc.

Wm. Clark & Co., Pittsburgh, Pa., have purchased thirteen acres of land adjoining the Carrie Furnace, near Braddock, but have not yet decided to what use they will put this ground.—*American Manufacturer.*

The wages of the Wason Car Company's employes at Brightwood, near Springfield, Mass., have been advanced 10 per cent., being now where they were about three years ago, when the last reduction was made.

The Powhatan Manufacturing Company—capital stock, $65,000—has been incorporated at Baltimore to manufacture cotton and woolen goods, by Daniel Halliday, Daniel Miller, David Ambach, George S. Campbell and others.

The Florence Land, Mining and Manufacturing Company, of Florence, Ala., have arranged to build three iron furnaces at once. It is stated that the company have granted sites for malleable iron works and brick works.

Robert Garrett, T. Harrison Garrett, Henry G. Davis, William Keyser, James Sloan and others are organizing a company at Baltimore to build works at Curtis Bay for manufacturing cars. The capital stock will be $200,000.

M. C. Foster & Son, Waterville, have nearly completed building a large brick shoe factory at Portsmouth, N. H., for the Portsmouth Manufacturing Company. The structure is 142x54 feet in size and six stories high. They will also build a boiler and engine-house for the same company.

The .Etna Machine Company, Warren, O., has been incorporated, with Charles Hickox, of Cleveland, and several citizens of Warren at its head. The works will be greatly enlarged, and the manufacturing capacity increased several fold. The company make engines and gas furnaces.

The Meteor, now lying at the Downing & Lawrence shipyard, foot of Court street, Brooklyn, N. Y., is having one of Ward's water-tube boilers inserted. J. M. Seymour, of New York, will soon build a large yacht with a guaranteed speed of twenty knots an hour. She will be fitted with a Ward boiler.

The Clayton Air Compressor Works, of Brooklyn, and 43 Dey street, New York, have issued Catalogue No. 5 of their air compressors, duplex or single, actuated by steam belt or gearing: also rock drills, hoisting engines, rock crushers, mining and boiler feed pumps, pneumatic locomotives, boilers and general mining machinery. The catalogue is dated January 1, 1887, is fully illustrated, and will be mailed upon application.

The Johns-Pratt Manufacturing Company has recently been organized in Hartford, Conn., to manufacture asbestos specialties for mechanical and engineering uses. The principal owners are H. W. Johns, of New York, and R. N. Pratt, of Hartford. A building has been erected, and work will soon begin. One of the specialties is a piston packing of unusual merit.

C. L. Jeffords, Jamestown, N. Y., previously reported as investigating the merits of several Southern cities as a location for his edge tool factory, has, with B. F. Moore, W. A. Handley and J. D. Moore, of Birmingham, Ala., incorporated the Birmingham Axe and Tool Company; capital stock, $100,000. The plant of Mr. Jeffords will be moved to Birmingham, Ala. — *Baltimore Manufacturers' Record.*

The stockholders of the Orange (Mass.) Manufacturers' Association have instructed the directors to buy the Clark lot on West Main street for a site for the new shop. J. B. Reynolds, of Brockton, has asked from $1,000 to $5,000 bonds that the shop will be ready by March 1, and will give bonds of the same amount that he will occupy it when it is done. The directors have been instructed to furnish the bonds.—*Boston Commercial Bulletin.*

The Bethlehem Iron Company, Bethlehem, Pa., is erecting a steel plate and shafting mill 650 feet long and 113 feet wide, which will be ready for occupancy in the early part of 1887. A wing, 91 feet wide and 700 feet long, is to be erected. No Bessemer steel will be used in the building, all the work being from the open-hearth steel The company intends to manufacture steel armor-plate, and has its eye on ordnance work, especially on the heavy steel forgings required by the United States Government.

The *National Labor Tribune*, of Pittsburgh, Pa., says: "This is the 1st December for many years that the iron and steel outlook has been as good as it is now. Two years ago there were from ten to twenty standing turn puddlers to be found in almost every mill in the city, and last year at this time there were some in every mill also. But now there are very few at Homestead. The nail trade is still the only discouraging branch in the iron business, and, so long as the demand for iron continues at the present price, there will be few nails made here."

The machinery firm of Beaman & Smith has just been formed at Providence, R. I., and a new shop and new tools secured to start business. E. A. Beaman was formerly with the Star Tool Company, and traveling for the last three years for the Brown & Sharpe Manufacturing Company. George H. Smith has been with the Brown & Sharpe Manufacturing Company nine years, eight of which he has been chief draftsman. They will build machine tools, and design and build special machinery to order. The shop is corner of Harrison and Westfield streets.

Machinists' Supplies and Iron.

NEW YORK, Dec. 23, 1886.

There are no new developments in manufacturing or in the supply business, except it is a strong feeling that business prosperity has come to stay.

Iron—There is a strong feeling in the future of American pig. Production has been closely absorbed, and prices are held firm. We quote Standard, Lehigh and North River brands, No. 1 X Foundry, $20 to $21; No. 2 X, $19 to $20; Grey Forge, $17 to $17.75.

Scotch Pig—There has been a slight advance in prices. We quote Coltness, $22; Glengarnock, $22.50; Gartsherrie, $20.50; Summerlee, $21.50 to $22; Dalmellington, $20.

Lead—4.30c.

Copper—Arizona, 11c. to 11½c.; Baltimore, 10¾c.

Antimony—Hallett's, 7.60c.; Cookson's, 9c.

Tin—Jobbing lots of Banca, 23c.; Straits and Malacca, 22.45c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Draftsman on machine tool work. Address, giving references, experience and salary expected, Tools, AM. MACHINIST.

Wanted — Two patternmakers experienced in pump work; only first-class men need apply. Deane Steam Pump Co., Holyoke, Mass.

Wanted—Situation as foreman in foundry doing engine and machinery castings; best of reference. Address J. H. T., AM. MACHINIST.

Wanted—A thoroughly competent man to act as foreman in a large machine shop, near Philadelphia, running upon heavy work; good salary and steady employment. Address X, AM. MACHINIST.

Wanted—Superintending engineer for a large works engaged in manufacture of general machinery in an Eastern city; must be experienced and energetic. Address confidentially, with full information, A. A. B., AM. MACHINIST, N. Y. city.

Wanted—Foreman for small factory; must understand the manufacture of small tools for the hardware trade, and be able to get up tools for the quick production of the same. Address, stating age, experience and wages expected, Box 12, AM. MACHINIST.

Wanted—Foreman for iron and brass foundry employing about 35 men; cored work largely; must be economical, strictly temperate, and able to manage men well; state wages wanted, and give references. Address "Core," AM. MACHINIST.

Wanted—A successful superintendent desires to change after April 1st, 1887; at present managing machine shop and foundry running 100 men; well up in steam engines, machine tools and general job work; salary low; reference the best, either as superintendent or foreman. R. E. B., AM. MACHINIST.

Wanted—A man as foreman of a foundry on agricultural and job castings: must be perfectly competent to take full charge of same, familiar with the Colliau cupola and melting with coke; also willing and able to solicit contract work. Address, with references, stating age and salary expected. The Victor Mower Co., Valatie, N. Y.

MISCELLANEOUS WANTS.

Advertisements will be inserted under this head at 5 cents per line, each insertion.

The Cyclone Steam Flue Cleaner has no equal, Crescent Mfg. Co., Cleveland, Ohio.

Crescent Boiler Compound has been used 40 years and still the best. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

John Lamberty, mfr. telegraph and electrical instruments, experimental machs, models; fine gear cutting a specialty. 35 S. 5th st., Br'kl'n, E.D., N.Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

Rare chance for a skilled working machinist, with moderate capital, to take half interest in a small jobbing and repair foundry and machine shop; always busy. Address "Success," AM. MACH.

For Sale—Foundry, machine and boiler shops; brick buildings, modern tools, and doing good business; good reasons for selling. Address Sioux City Foundry and Machine Works, Sioux City, Ia.

Experimental and new machinery for special purposes built by contract from specifications and inventors' designs; ample facilities. Cohoes Iron Foundry and Machine Co., Cohoes, N. Y.

For Sale—One complete set of Pulley Patterns also Patterns for Slide Valve Engines, with adjustable cut-off and without cut-off, for sale cheap Address North Star Iron Works Co., Minneapolis, Minn.

Machinists, Modelmakers, etc.—One 22-inch swing "Lincoln" lathe and one 6-inch swing hand lathe, with forge and bench, good light and steam-power, to let. Apply by letter, with references, to Steam X, AM. MACHINIST.

Power.—Parties of moderate means having articles of merit to manufacture can be furnished with power and steam heat at reasonable rates in one of the best villages in New York State; good schools and water, low rates of freight and low taxes. Full particulars can be obtained by addressing Power, AM. MACHINIST.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.

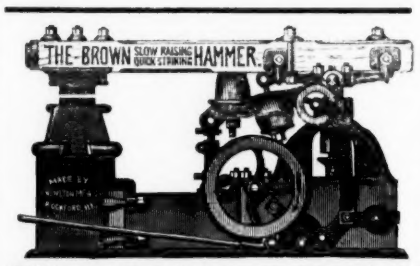
Combines all the best elements essential in a first class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the World.

BRADLEY & CO. Syracuse, N.Y.

BEAUDRY'S UPRIGHT CUSHIONED POWER HAMMER

The success of our machine is the best proof of its value. Is more like a steam-hammer than any other, yet has all the economic advantages of a power hammer, and is far superior to any. Will work a larger bar of steel or iron and turn out more difficult forgings than any other hammer made. **Guaranteed as represented, or no sale.**

BEAUDRY & CUNNINGHAM,
Boston, Mass.



THE BROWN HAMMER
STRIKES A BLOW WITH
Double the Velocity That It Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION.
Knowlton Mfg. Co., King St., Rockford, Ill.

STEPHENS PATENT VISES.

50 PER CENT. OF time and labor saved by using this solid, strong, durable, quick-working Vise that the Improved Taper, Pipe and other attachments. Sold by the trade. Send for circular

MELVIN STEPHENS, Prop'r.
Office, 41 Dey Street, New York

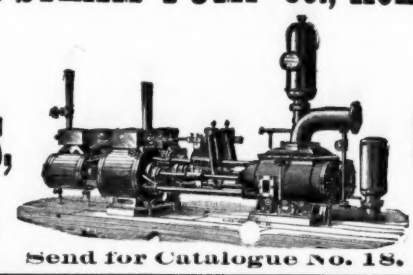
FOR SALE.

Valuable Manufacturing Property, centrally located in one of the largest Western States, with a well established reputation for the goods of its manufacture, which consist of engines, boilers, saw and grist-mill machinery, and kindred articles. Property all in first class condition; tools and machinery in good order, and the works now running. Parties who mean business, and desire to engage in a profitable and well established business of this character, can get full particulars by writing or applying in person to M. D. WHEELER, Stapleton Staten Island, N.Y., or, MANNING, MAXWELL & MOORE, 111 & 113 Liberty St., New York.

PATENT UNIVERSAL SCREW-CUTTING, CENTER, PER... ANGLE AND **TWIST DRILL GAUGE**
J. WYKE & CO.
Fine Machinists' Tools, E, BOSTON, MASS. Send for Circular

THE DEANE STEAM PUMP CO., HOLYOKE, MASS.

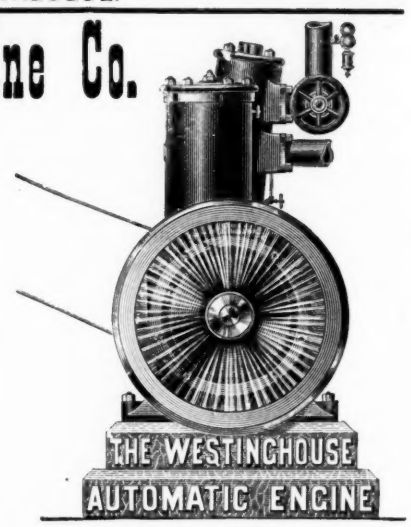
BUILD WATER WORKS, ENGINES AND STEAM PUMPING MACHINERY.



Send for Catalogue No. 18.

THE HENDEY MACHINE COMPANY,
TORRINGTON, CONN.
SHAPERS, PLANERS, LATHES, DRILLS, and SPECIAL MACHINERY,
SEND FOR CATALOGUE.

Westinghouse Machine Co.



Sales List for November, 1886.

			H.P.
South Side E. L. Co.		Pittsburgh, Pa.,	150
" "	2d order,	" "	150
Union Switch and Signal Co.	6th order,	" "	75
East End E. L. Co.	2d order,	" "	75
" "	3d order,	" "	75
Brush E. L. Co.	2d order,	Buffalo, N. Y.,	60
McConway & Torley,	2d order,	Pittsburgh, Pa.,	60
Winona Paper Co.	4th order,	Holyoke, Mass.,	60
N. Y. & Manhattan R. E. Co.		New York,	60
Mather Electric Co.		Hartford, Ct.,	60
" "	2d order,	" "	60
Jefferson City E. L. Co.		Jefferson City, Mo.	60
Wahoo E. L. Co.		Wahoo, Neb.,	60
J. C. Livingston & Co.		Little Falls, N.Y.,	45
Weidman Silk Dyeing Co.,		Paterson, N. J.,	45
Miller, Broudy & Co.		Alexandria, La.,	45
E. L. McLain Mfg. Co.,	2d order,	Greenfield, O.,	45
Van Deventer & Horne		Plainfield, N. J.,	35
"The Public Ledger"	2d order,	Philadelphia, Pa.,	35
" "	3d order,	" "	35
" "	4th order,	" "	35
" "	5th order,	" "	35
E. Balbach & Son	14th order,	" "	35
Wolff & Hamaker		Chambersburg, Pa.	35
Imperial Guano Co.		Norfolk, Va.	35
Chandler & Price		Cleveland, O.,	35
Wabash, St. L. & Pacific R. R.	2d order,	Ft. Wayne, Ind.,	35
Barnes Bros		Maquoketa, Ia.,	35
A. J. Mullen		Selma, Ala.,	35
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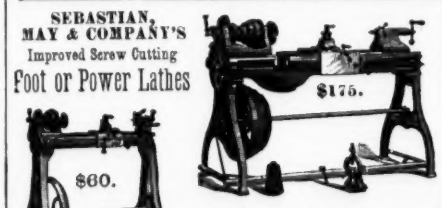

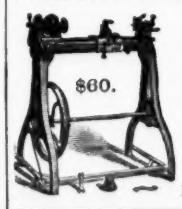

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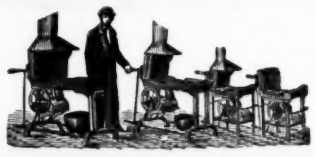

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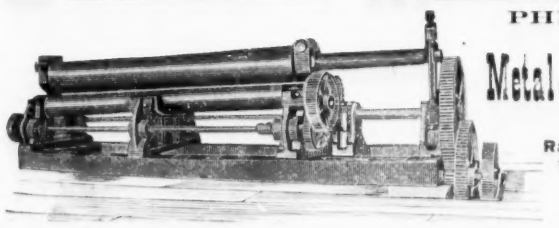

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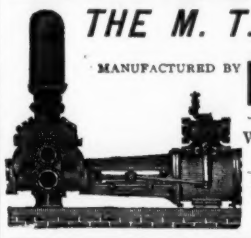

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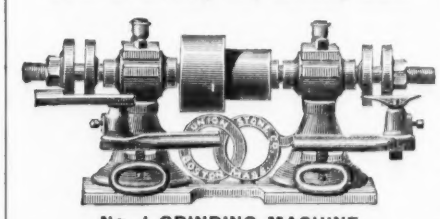

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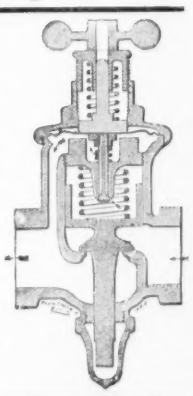

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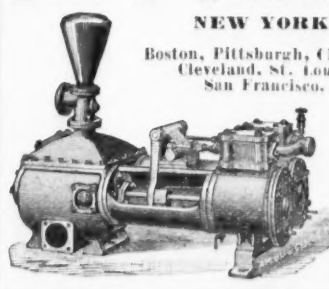

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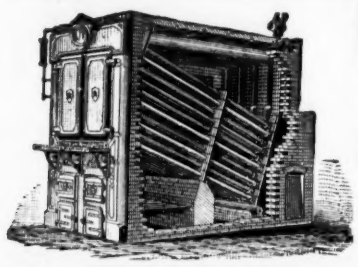

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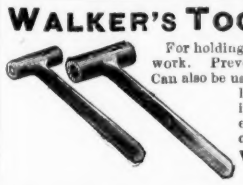
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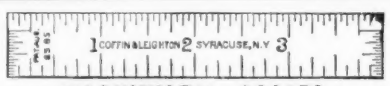

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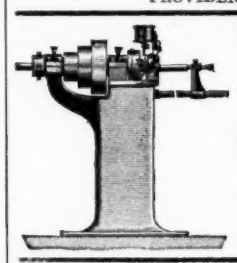
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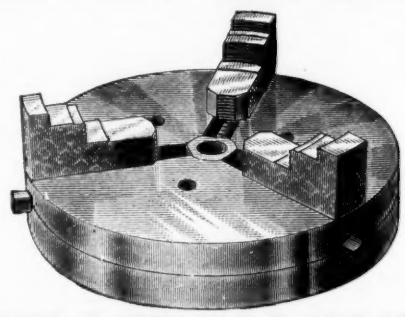
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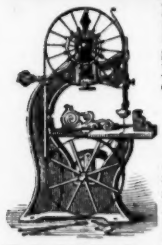
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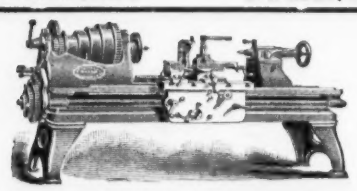
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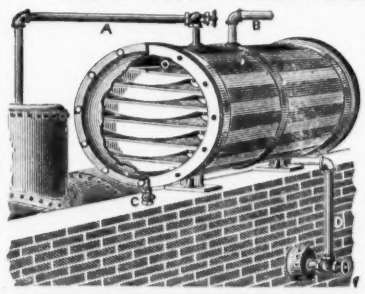

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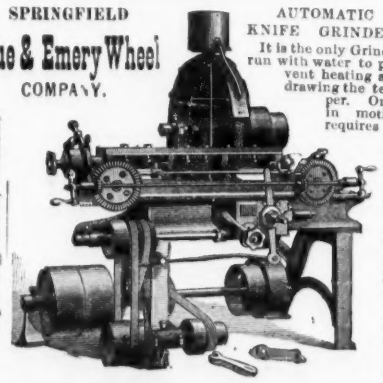
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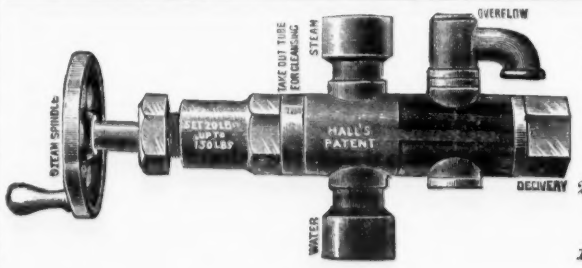

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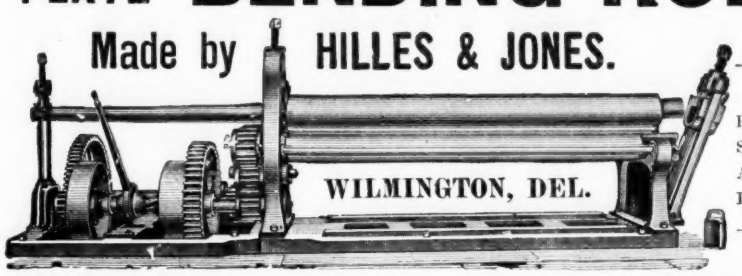

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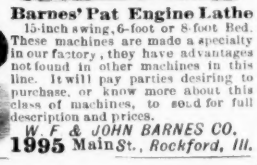

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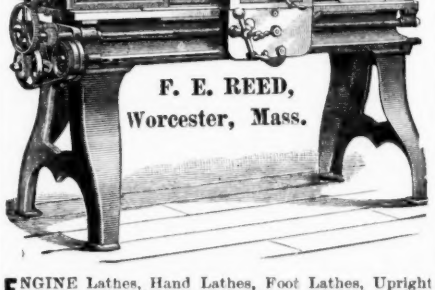

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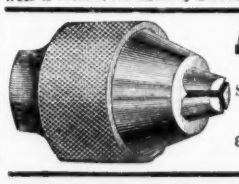

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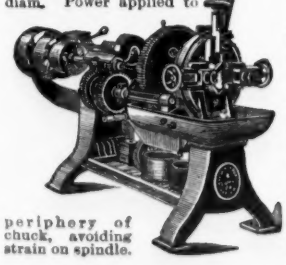

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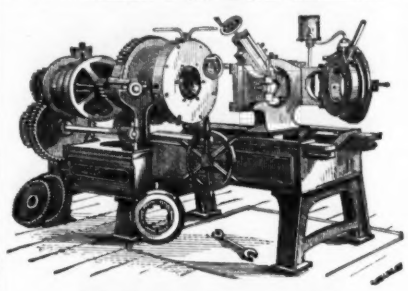

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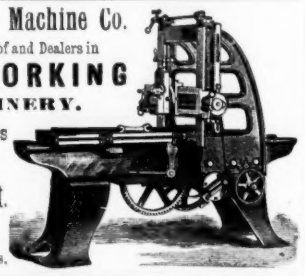

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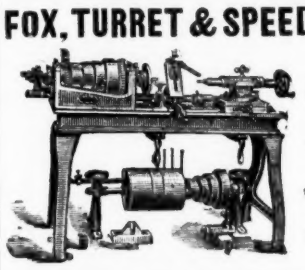

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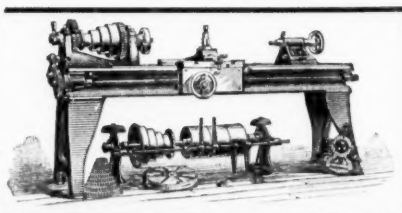

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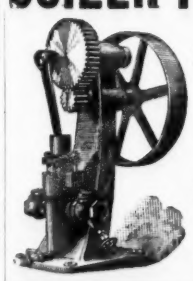

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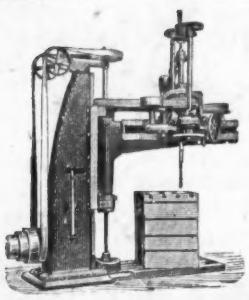

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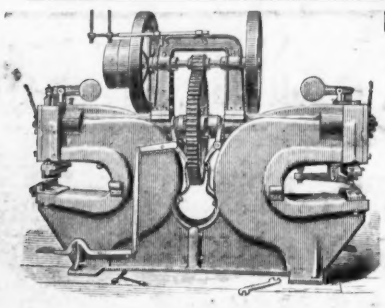

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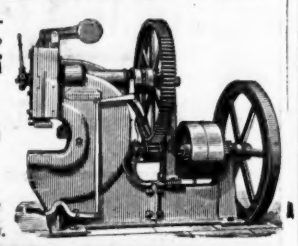

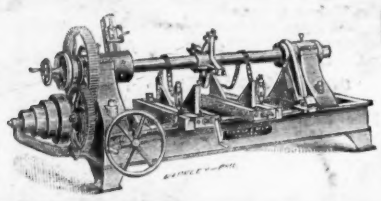

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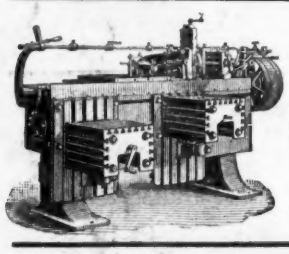

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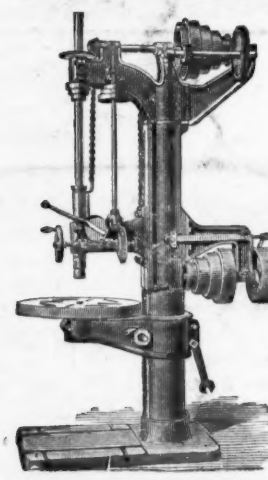

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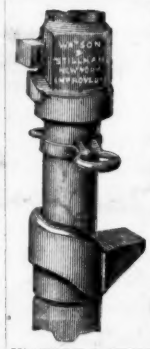

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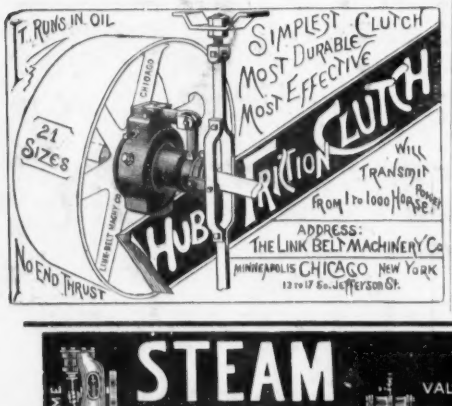

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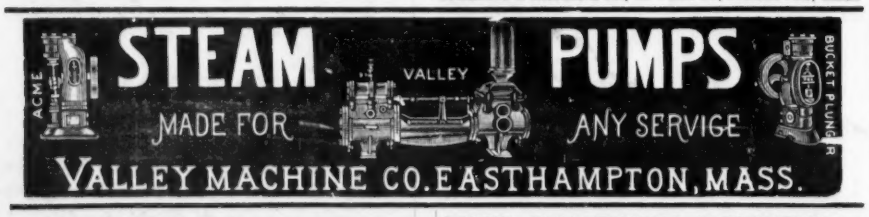

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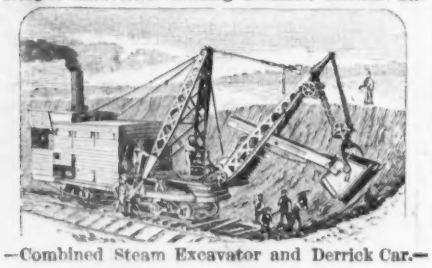

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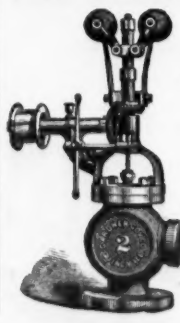

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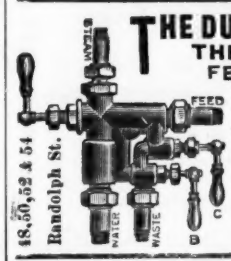

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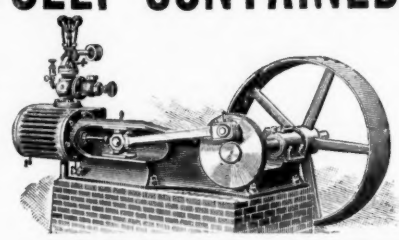

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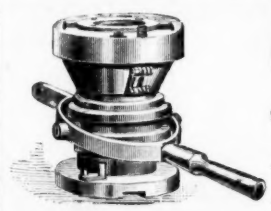

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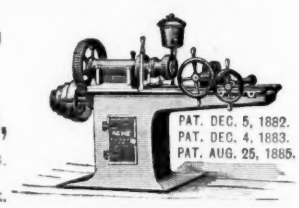

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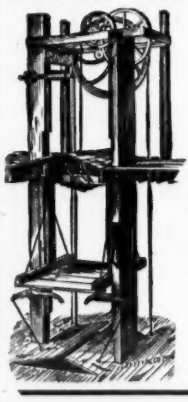

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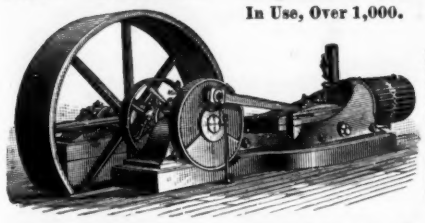

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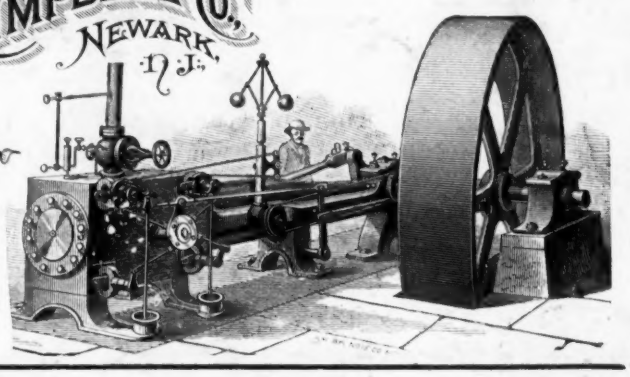

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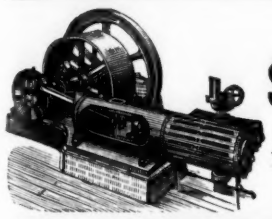

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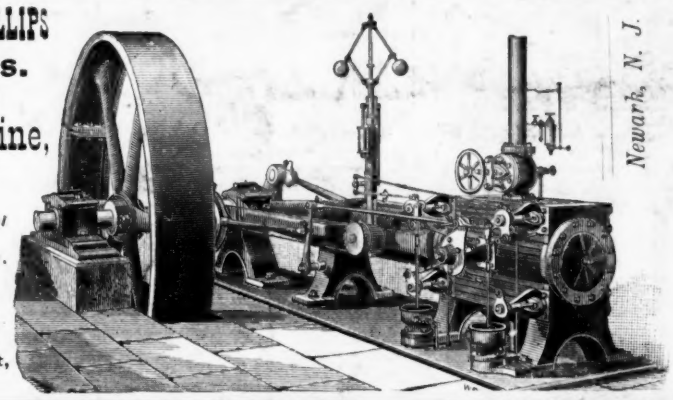

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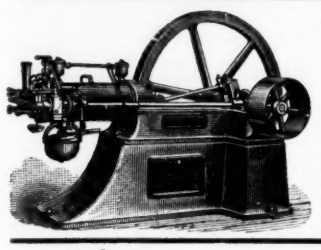

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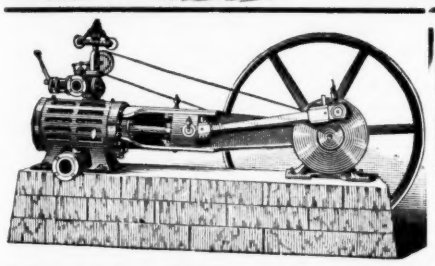

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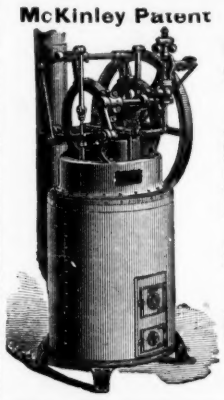

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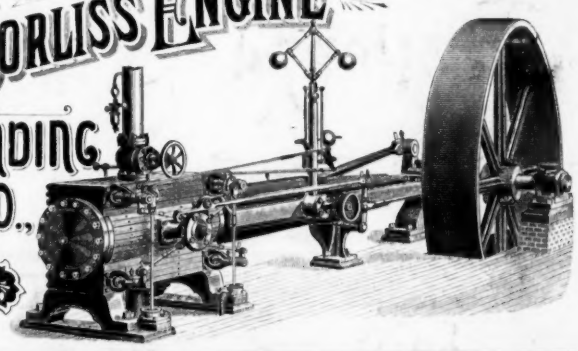

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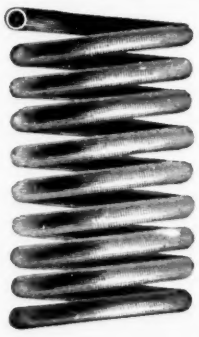

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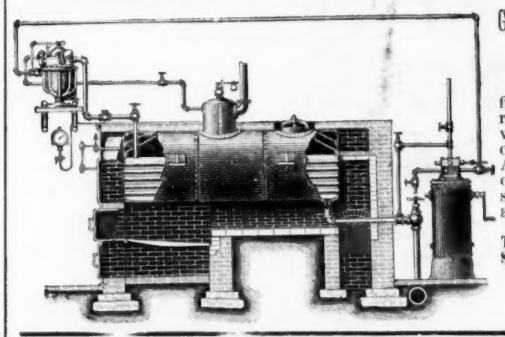

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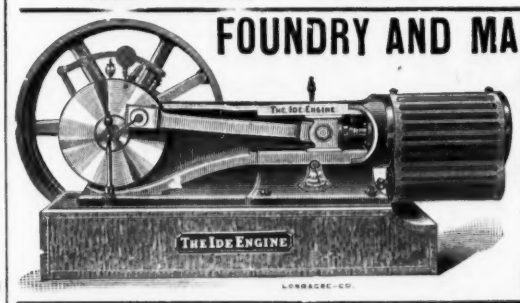

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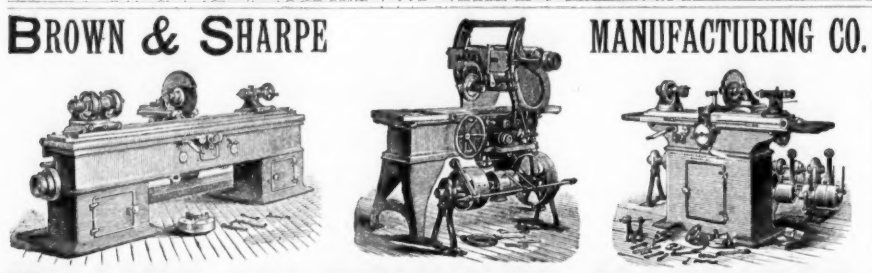

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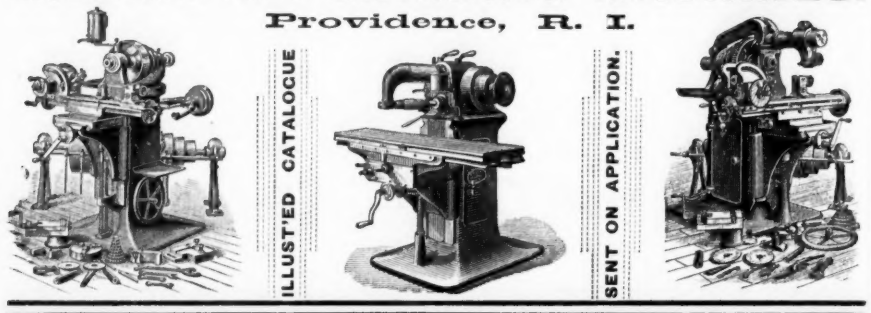

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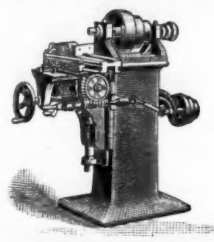

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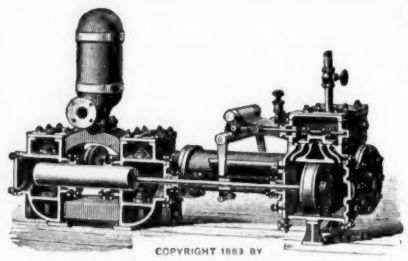

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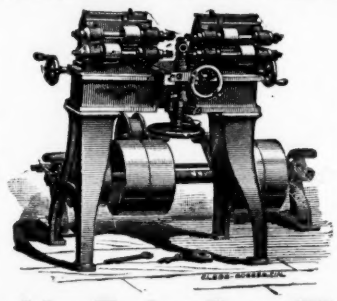

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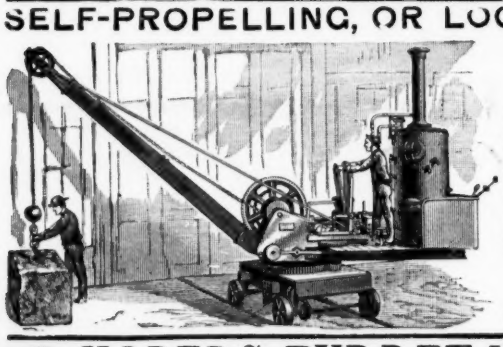

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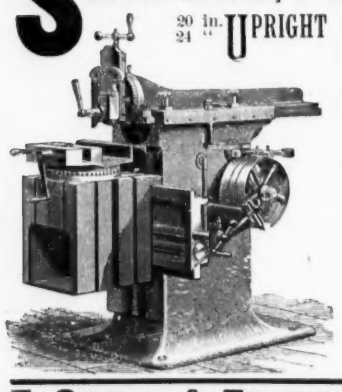

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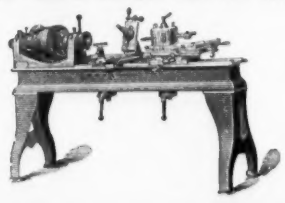

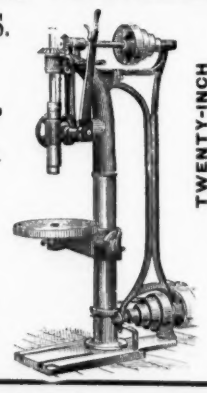

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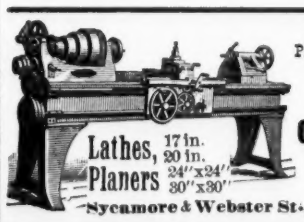

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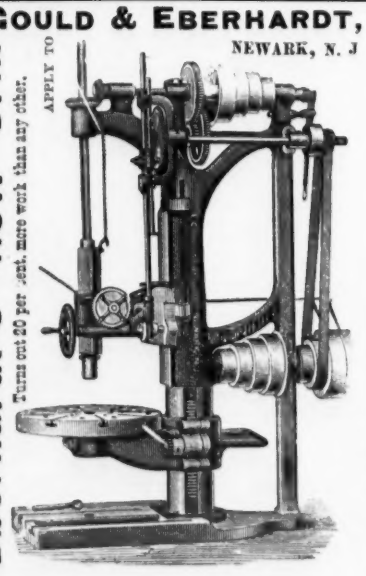

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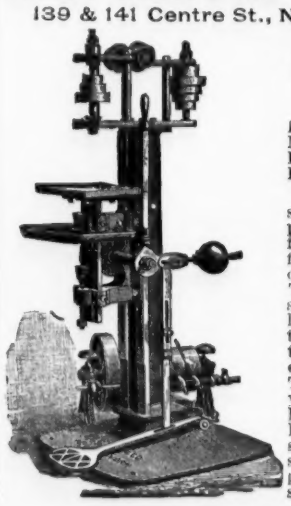

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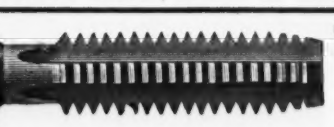

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